THE

ELECTRICAL REVIEW.

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"ELECTRICAL REVIEW."

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THE

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THE DISCOVERY OF THE TECHNICAL MAN.

IT is difficult to know how to take the Presidential address which Mr. Andrew Carnegie delivered to the Iron and Steel Institute on Thursday, May 7th last, for it may be regarded as a most valuable pronouncement, as containing nothing beyond experimental proof of a truth which has been known to everybody except capitalists and company promoters since the beginning of things industrial, or as a most amazing utterance in view of the class to which its audience belonged. Mr. Carnegie himself would, no doubt, say that the text of his speech was the advantage of profit-sharing; but, in reality, his whole argument was an announcement or admission that the technical man, as well as the commercial and financial man, is of sufficient importance in modern industry to deserve a share of the profits which his brain has helped to create.

In olden days the tradesman was his own employer, technical expert, clerk, cashier, workman, and traveller; and he probably viewed each phase of his own character as equally important. Later on came sub-division, but the different branches of the business were co-ordinated in a partnership, or so directly and humanly subordinated to one approachable chief that each man had, and felt that he had, an interest in the welfare of the concern. It remained for the principles of "joint-stock" and "limited liability" to reduce the technical man and inventor to the position of an immeasurably distant inferior—a person who could be adequately recompensed by throwing him gold or banknotes as the sole reward of his labours. Gold is a most useful commodity, especially when there is plenty of it; but so complex a being is man, especially a man of brains, intelligence, and sentiment, that he is apt to work less wholeheartedly even for a princely salary than for a smaller salary accompanied by more or less tangible recognition of his services which takes the form of profit-sharing or the like, or even of genuine thanks. Many of our readers have erected plant or works—that is to say, they have designed works, erecting them with the aid of money provided by some other single individual, or by a company. Even if the "proprietor" is a single person, it is no exaggeration to say that the engineer takes more interest in, has a greater love for, feels more keenly the success or failure of the enterprise, than the proprietor. But in general the proprietor takes to himself all the credit, sentimental and pecuniary, attaching to the concern, and if it fails, simply loses so much money, promptly starting upon a new venture, while the expert is given a fixed salary, with, perhaps, a "rise" if the business pays, and the loss of his situation if it fails. If it fails, however, not only does the expert suffer more in reputation than the financier, but he sees the offspring of his brain and affection perish; and when he is an honourable man his pain and disappointment are too keen to be measured in

pounds sterling. This is a mere truth which has been known for a long time, but capitalists have usually ignored or denied it implicitly hitherto; and capitalists are a class of mankind who listen to and believe in capitalists only.

For this reason Mr. Carnegie's address is a most valuable pronouncement, for here we have a pure man of business and a millionaire actually admitting that the success of the ventures with which he has been identified has been largely due to the fact that the financiers have so far acknowledged the value of the services rendered by their technical assistants as to make them partners and participators in the meetings of the advisory boards of management. Only a capitalist could ever have imagined the opposite, and only a capitalist could convince his compeers of the value of technical ability. Perhaps as Mr. Carnegie has demonstrated the truth of the faith that is in him by reaching the summit of most human ambition (*i.e.*, by becoming a millionaire) other capitalists in this country may see the error of their ways, and, by giving their specially-trained assistants more encouragement to work hard for their employers, may cease to offer passive resistance to improvement in education, and may do their share towards keeping the country in the van of progress. For the identical reason, Mr. Carnegie's speech must be regarded as an amazing utterance; because, unless it was intended as a vicarious recantation or apology, its author must have needed some self-confidence to make such obvious remarks before the Iron and Steel Institute, which is one of our best known "learned" societies, and is composed for the most part of technical men. His audience, indeed, must have listened with somewhat mixed feelings to Mr. Carnegie's lengthy argument that the success of a manufacturing venture does not depend wholly upon the skill of its commercial department; and they may, perhaps, have been faintly amused to hear Mr. Carnegie's naïve admission that it actually paid the Carnegie Steel Co. to give one of its works managers a salary as large as that received by the President of the United States, and one larger than that taken by any of the salaried "presidents" of the concern.

Mr. Carnegie describes in detail the method by which the Carnegie Steel Co., of the United States, has allowed its departmental managers to become partners, and shows with what beneficial results to those managers, but chiefly to the company, the policy has been followed. But the company has gone further than this, and has opened up similar facilities to the actual workman, permitting him to take preferred shares in the concern up to an amount corresponding with a certain percentage of his wages. We have no space to explain the precise mechanism of the ingenious scheme adopted, which enables the workman gradually to become a stockholder, and to receive dividends, without the necessity for handing over any large sum of money, and which makes the employé, morally, if not legally, a preferential creditor. In principle the idea is sound and highly praiseworthy; for, appealing to every man's commercial instinct, it encourages each workman to effect those petty economies which are beyond the power of the manager, but upon which the success of the whole enterprise so largely depends. In practice, as it has been argued, the plan has the defect of not giving absolute security for the workman's savings, these being more or less absorbed in the company, and so liable to shrinkage or disappearance, should the undertaking partly or completely fail; while it may tend to convert the man into a mild speculator having one eye on his work and the other on the stock market reports. The latter danger has been circumvented by the Carnegie Co., who so arranges matters that the workman's deposit stock is not publicly quoted; and perhaps the former is less serious than appears, because, without this incentive to thrift, the average workman is far less likely to have any savings to preserve or to lose. Still, to whatever extent the danger is real or near—and all industrial enterprise is hazardous—it should be a comparatively simple matter for the financial authors of such a scheme to elaborate a plan for safeguarding the employés' deposits, partly, may be, by a reserve fund covered by outside stock (one or more "trustee" or "gilt-edged" investments), but mainly by obtaining, where necessary, definite legal power to hold the deposits a first charge upon the company's property.

There are, naturally, other ways of arriving at a similar result, for it is possible to pay by the piece or according to the bonus system. In practice these two plans amount to much the same thing, and they have several defects. The extra recompense given the men takes the form of actual cash in hand which, in present conditions at least, is quite as much an incentive to extravagance or immediate "enjoyment" of the money, as an encouragement to thrift. Money payments, too, rather tend towards scamping, and an habitual performance of inferior work; which is one of the two things that the abolition of simple payment by time is expected to abolish. Moreover, with kindred objects in view, piece-payment and bonus-giving are not applicable to the superior officers of a company, or at any rate, are far less properly applied to them than to the men who do the actual work.

On the whole, then, it would seem that a scheme of profit-sharing, with proper safeguards and under careful management, should be actual "good business" for any large manufacturing company; and workmen as well as higher technical officers owe Mr. Carnegie a debt of gratitude for demonstrating the fact to other financial magnates by his own success in life. Any method of profit-sharing must bring the employés into closer personal contact with the employer, and so perform an inestimable service to both; on the one hand by showing the workman that the employer is, after all, human and humane; and on the other, by teaching the employer that human beings love and take interest in their work, as much when it is the product of their hands or brains, as when it is simply the offspring of their pockets.

Radio-activity.

A NUMBER of interesting papers on radio-activity have been recently read before the American Physical Society. Mr. S. J. Allan has found that freshly-fallen snow is radio-active, and that its radio-activity decays according to the geometric progression law, as in the case of the radio-activity induced by a negative charge on a wire. The rate of decay is, however, different in the two cases; in the case of freshly-fallen snow the radio-activity falls to half its value in about 30 minutes, while in the case of the wire it falls to half its value in about 48 minutes. The penetrating power of the radiation was found to be about the same in the two cases. The amount of radio-activity in the snow was found to vary as the amount of snow falling per second. It appears from this that the negative electrons picked up by the snow must have something to do with its radio-active properties.

A still more interesting series of experiments have been carried out by Mr. I. C. McLennan at Niagara Falls. Lenard has shown long ago that the atmosphere in the neighbourhood of waterfalls is highly charged with negative electricity. The impact of the water at the bottom of the fall appears to liberate negative electrons which diffuse into the surrounding atmosphere, while the corresponding positive electrons are retained in the water drops.

McLennan's object was to ascertain whether atmospheric conditions so exceptional would have any influence on the amount of radio-activity induced in a negatively-charged wire.

Before proceeding to Niagara, and after returning, a series of experiments was made in Toronto. Copper wires of about 30 m. long were exposed on a number of days for periods of two hours, at a potential of 8,000 to 10,000 volts. After a wire had been exposed it was placed in an ionisation chamber, the saturation current was measured, and its radio-activity thus ascertained, was expressed in terms of a standard radio-active substance. The resulting values varied from 1·75 to 0·6. The values between these two

limits appeared to depend more upon the existence of wind and its velocity than upon any other changes of the weather. The occurrence of showers did not exert any noticeable effect on the amount of radio-activity excited. It was frequently observed that exposures made in the morning gave greater induced radio-activity than those in the afternoon, but exposures made after sunset gave values generally equal to and sometimes greater than those of the morning. It is well known that the ultra-violet rays in sunlight facilitates the discharge of negative electrons from the surface of the earth into the atmosphere, and consequently we should expect to find the largest percentage of negative electrons in the air in the afternoon. The large percentage of negative electrons in the air at Niagara was found, as we shall see, to act in the same way by reducing the amount of the induced radio-activity.

In the experiments at Niagara Falls, three wires about 30 m. in length were suspended on insulators at the foot of the fall. The first length of wire was generally enveloped in very fine spray, the second wire was in a still heavier spray, and the third wire in a downpour resembling the heaviest rain. A point of peculiar interest was that a wire as soon as it was placed in the spray acquired a potential of about 7,500 volts, and this potential was invariably negative. It was demonstrated by suitable tests that the negative potential of the wire was due to the spray, and that the voltage depended on its density. On account of the permanency of this negative charge it was found to be unnecessary to employ an electric machine to maintain a charge in the wire.

Exposures of the wires were made on four different days, with the result that the induced radio-activity on the first and second wires showed little variation. The third wire, nearest the Falls, showed measurable radio-activity on one day only out of the four on which the exposures were made. But the most remarkable discovery made was that the induced radio-activity at the Falls was on the average only one-sixth to one-seventh of that observed at Toronto. The conclusion seems inevitable that in an atmosphere highly charged with negative electrons the induced radio-activity of a charged wire is very low.

Law's Expense.

To the uncertainties of law, and to law's delays, modern times have added a new terror, or, to put it more correctly, an increase of an old terror, namely, law's expense. It would be interesting to compare the costs of an average case now, with those of, say, 50 or 100 years ago. Most readers have some vague notion of the cost of conducting a lawsuit, but such vague notions are probably greatly in error when contrasted with the actual figures. A recent case which has excited considerable interest in electrical circles is probably as good as any to take as a fitting instance of the costs incurred in a lawsuit of comparatively small dimensions. There were not many witnesses called, and the expert evidence was confined to two gentlemen. The sum involved could not, in any event, have exceeded £6,000 in all; indeed, about half of that amount was recognised to be the utmost that would be given. During the course of the case it was estimated that each day's hearing was costing £200, and, at the conclusion of the case, the losing parties were faced with a bill for their own and their opponents' costs, which could not have fallen far short of £4,500. To put it still plainer, it may be added that this was £1,600 more than the amount involved. The sum named does not include, it might be added, the costs incurred in working up the case, so that it will be seen, that taking into account all the expenses, the bringing or defending of a lawsuit involves a considerable risk.

THE LITIGATION ON MAGNETIC BLOW-OUT APPARATUS.

The recent action brought by the British Thomson-Houston Co. against the Manchester Corporation for an injunction to restrain the defendants from infringing electrical patents as applied to traction controllers was an interesting one in many respects. It aimed at what may almost be termed the fundamental portion of a tramway controller, but it further had an important bearing upon the use of magnetic blow-out apparatus in regard to all circuit-breaking apparatus. Though the Manchester Corporation were nominally the defendants, the real parties to the dispute were the British Thomson-Houston Co. and Dick, Kerr & Co., and naturally a contest between two such firms was watched with the closest interest, because the issue would clearly influence purchasers of series-parallel controllers, and also materially affect the future manufacture of such apparatus. Occupying as the parties do such a prominent position in the electrical traction world, it was for many reasons desirable that the action should be fought out to an issue.

It is unnecessary to go into the case in detail, because full reports, as well as the judgment, have already appeared in our columns. Briefly, the action was one which depended entirely upon the use of magnetic blow-out apparatus in combination with an insulating shield; that is to say, the plaintiffs had found it necessary in the use of such apparatus to protect the magnet by means of an insulating shield, thus enabling it to withstand the effect of any sparking which arose between one point and another in contiguous apparatus. It was freely admitted by Prof. Ewing, who was called on behalf of the plaintiffs, that there was nothing new in the use of a magnet as a means of rupturing an arc; but in combination with the arc-rupturing device the plaintiffs employed the shield, and on this the whole action pended. Put in another way, in order to realise the full advantages of a magnet in rupturing an arc it was incumbent to place it as near as possible to the point of operation, and obviously this could not be done with success unless the magnet was protected against the effect of the spark or arc. The next obvious step, therefore, was to employ some form of insulation over the magnet, and the defendants relied entirely upon the obviousness of such a step. As Lord Kelvin aptly put the matter, If air did not supply you with a sufficient thickness of insulation, then clearly any electrical man would employ a higher form of insulation. The issue was therefore a comparatively simple one, and it needed very little expert evidence to demonstrate the point of either the plaintiffs or defendants. There were no nice points of patent law to be considered, and it was mainly a question as to whether the plaintiffs had shown any inventive faculty, and the Judge very speedily determined that there was no subject matter, and dismissed the action with costs.

The result of the action is a most important one as far as the electrical industry is concerned, because it once for all clears the entire position regarding the manufacture of series-parallel controllers. It has been generally admitted that the most important features of a series-parallel controller were the use of a magnetic blow-out and an insulating shield, because only by such means was it possible to obtain apparatus of moderate dimensions. Electrical manufacturers, with one or two exceptions, have held aloof from the manufacture of traction controllers, and there is little doubt that much of this was due to the existence of what were thought to be master patents. The position, therefore, as regards the electrical industry, is that anyone can now embark upon the manufacture of such apparatus, and we imagine that English manufacturers will not be slow to avail themselves of this opportunity, not only as regards the manufacture of controllers necessary in traction work, but in other and equally important directions; in fact, the magnetic blow out and its insulating shield has a wider field in power work, and therefore manufacturers need not now hesitate in applying this principle to the whole of their switches and circuit breakers. There is little doubt, as we have hinted, that manufacturers have been averse to employing this apparatus, and there is no doubt that in some cases where they have employed such a device they have paid royalties to the plaintiffs in the above action. The electrical industry has, therefore, some reason to be thankful to the defendants'

company that they had the courage to fight this action to a finish, and they are to be congratulated not only upon the result of the action, but also that they have had the necessary courage to sustain their convictions during a prolonged period of pending litigation.

There was a notable feature developed in the case in the form of an exhibit of a modern controller made by the defendant firm, which represented one of the latest forms of series-parallel controllers. It was interesting because it was an entire departure from the form of arc-rupturing device and insulating shield on which the plaintiffs sued, and, moreover, was the only type now made by the defendants. In other words, quite apart from litigation, a process of evolution has been going on in regard to this apparatus, and the plaintiffs were, in effect, suing on a controller which had become obsolete as far as the defendants were concerned. The new controller covers the well-known form of metallic shield blow out which has been already described in these columns, and of which we understand most important patents are held by the defendants.

CORRESPONDENCE.

Municipal Electrical Undertakings.

I am sorry I should have caused such deep concern to Mr. Appelbee by inserting, in quite a haphazard way, Ashton-under-Lyne as one of the towns working at a loss. I will not attempt to combat his statements, but simply give the revenue account of his balance-sheet for the year ending March, 1901, upon which I based my statements:—

REVENUE ACCOUNT.

RECEIPTS.				EXPENDITURE.			
Sale of current	£2,746	9	5	*Generation*—			
Sales by contract	4,208	11	8	Coals	£4,004	13	10
Public lighting	1,338	9	0	Oil, waste, &c ...	315	1	3
				Wages	931	19	6
				Maintenance ...	421	14	5
	£8,293	10	1		£5,673	9	0
Rental of meters	49	3	8	Distribution ...	233	17	5
Sale of lamps ...	221	0	6	Public lamps ...	269	16	7
Stocks on hand, increase ...	152	16	0	Rent, rates and taxes... ...	280	12	6
Balance carried forward ...	2,982	1	1	Management ...	741	14	1
				Law & insurance	187	3	6
					£7,386	13	1
				Balance last account ...	2,074	13	11
				Interest ...	929	13	4
				Sinking fund ...	941	9	1
				Bank interest ...	366	1	11
	£11,698	11	4		£11,698	11	4

If this balance-sheet is incorrect, why was it issued?

The Writer of the Article.

In your issue of the 15th inst. (p. 851) an article under the above heading was written by a "Consulting Engineer." It is unfortunate that this gentleman prefers to write under a *nom de plume*; but when one considers and weighs carefully the figures and statements given, I can quite understand him desiring his name to be kept secret, he having so juggled with his depreciation figures as to make them become, to any engineer of practical experience, an absurdity.

To give an instance, does "Consulting Engineer" really mean that the mains for an electricity supply works, when laid on an up-to-date system, require absolute replacing every eleven years? If so, I am afraid "Consulting Engineer" does not know the life of lead, iron and copper, all of which are component parts of the mains. Is he aware that, even when the mains break down, it is not necessary to take them all up, but that small pieces can be replaced? Will you kindly tell him that the value of the pieces taken up, is as much as £30 a ton for the copper, and the other metals according to their market value; also, that the life of a lead-covered cable depends, to a very large extent, upon the life of the lead jacket, and that there is no reason to suppose that, with due care, these cables will not last as long as 50 years, or perhaps even longer, provided they are used properly, and not overloaded, and that at the end of that period they will fetch a considerable sum as *old metal*.

There is a considerable amount of ingenuity displayed in the care with which he puts the large percentage to be allowed for *depreciation* against the items involving the *largest* capital outlay such as the mains, plant and machinery, whereas electrical instruments and public lamps (because the capital outlay in any undertaking involved on such things is so small), he considers a life of 25 years probable. Allow me to inform "Consulting Engineer" that if he had put 2½ per cent. against the mains, and 5 per cent. (or even less) against the plant and machinery, and the 7½ per cent. (or even more) against electrical instruments and public lamps, he would have been nearer the mark, and it would have shown that "Consulting Engineer" had had practical experience, and knew what he was talking about.

I am not in any way writing on behalf of municipal undertakings, but I would ask "Consulting Engineer" whose expert knowledge must be of such value, to apply the same arguments to the companies' undertakings, and work out their accounts in a similar manner, when he will find nothing but downright starvation, financial ruin, and the Bankruptcy Court staring all the undertakings in the face, be it company or municipal; therefore he assumes the *rôle* of condemning the whole of the company directors, many of them men of great experience and expert knowledge, controlling our large electric light supply concerns, and the whole of the committees and their expert advisers, all of whom, it is quite evident, this "Consulting Engineer" does not think much of, and, if his views are correct, I should advise him to give up everything to do with electricity supply at once, and to seek a more remunerative and a more exciting pastime than one which leads to the workhouse eventually!

He states that "anybody who has had experience in central stations will say this depreciation is greatly underestimated"; it is clear, therefore, Sir, that my 15 or 16 years' central station experience in various electricity works in the kingdom counts for nothing against this "Consulting Engineer" and also the experience of my *confrères* engaged in a similar profession, because they do not set aside the amount "Consulting Engineer" considers necessary.

I am sure, as one of the engineers to a municipal undertaking, the thanks must be given to him for "sounding the warning note," but I can assure our friend that in this town's undertaking they would have no trouble to-morrow in finding a company only too willing to take over the whole of their business, and give them £40,000 profit for so doing over and above their capital outlay.

It has always been a surprise to me that your correspondents and writers of articles have endeavoured to throw cold water on electricity supply undertakings, and thus preventing the general public from putting the money, and placing the *confidence* in them that they otherwise would do, because it can only have one ultimate result, and that is, to restrain the market in electrical supply shares to a few people who know what they are doing; therefore it is more on behalf of the whole electrical industry that I am penning this letter, because I do not believe for one instant that these articles occurring over and over again on the question of municipal electricity supply do any good, but only help to shake the confidence of the public in the electrical supply industry generally. I am quite satisfied to find that electricity supply authorities, either municipal or otherwise, compare very favourably with the majority of rival gas companies in the amount set aside for depreciation, and I have before me the balance-sheet of a very successful gas company, from which I find that it is not considered necessary to set aside very large sums for depreciation in addition to keeping the works in perfect repair from year to year.

I quite appreciate the point raised by "Consulting Engineer" with reference to replacing all machinery before it is worn out, but I would here sound a "warning note" as to the importance of following "fashions." For instance, in the early days continuous and single-phase alternating current systems were considered *the things*. To those engineers who are always trying to be in the fashion and are never satisfied unless they are changing one engine for another and one form of distribution for another, without regard

for the heavy capital outlay entailed and the inadequate return for this extra expense I have repeatedly heard it said that, after all, the original system had many advantages, and that in making the change, the troubles in store were not appreciated; when they changed over they did not fully appreciate the troubles that were in store for them. It is something like the ladies' fashions of to-day. Unlike their ancestors, the ladies of to-day never trouble to wear out their garments, but before they are almost soiled, they are put aside and changed for something more in the fashion, simply because others do the same. Personally, I believe we shall all come back to the single-phase system. There is at present only one objection, and that is the question of starting motors: as soon as a suitable motor is invented, the single-phase system becomes the simplest and the easiest to handle, the cheapest to put down, and the most reliable high-pressure system there is.

Horace Boot,
Consulting and Resident Engineer,

Tunbridge Wells, *May 26th*, 1903.

A New Detective Agency.

Will you kindly state in your next week's issue if there is an instrument which, by means of an electric current, enables a person's conversation and movements to be investigated as he moves to and fro the streets of London. If you will kindly answer the above question you will greatly oblige.

J. Hopwood.

London, *May 23rd*, 1903.

[We sincerely trust, in the interests of our readers, that no such instrument will ever be invented!—Eds. Elec. Rev.]

Storage Batteries and Reversible Boosters.

There has been a great tendency of late on the part of engineers to instal storage batteries to work in conjunction with automatic reversible boosters, to control the output, so that the generators are kept approximately at full load during working hours. It is, of course, far more applicable to traction than lighting systems, but I should like to see a definite ruling on the following point which concerns battery manufacturers more particularly:—

Assume that one or more sets in the station are running at full output and the external load falls. Owing to the constant output the balance must go into the battery, and if this occurs a number of times during the day, it will be found that the total number of ampere-hours charged, exceed very considerably the ampere-hours discharged.

I am aware that it is quite possible to so set the control that the over-charge cannot be very severe, but at best the outside load can only be approximated, and I anticipate some difficulty on the part of battery makers in giving the usual guarantees. Over-charge has been proved to be very detrimental, and this contention has been upheld by one of the most prominent manufacturing companies, and it seems to me a poor look-out for the central station engineer, who has such a system under his control, if the makers disclaim responsibility for the satisfactory working of the cells under these conditions. It is short-sighted economy to sacrifice an expensive battery simply to keep generators fully loaded, and as it is quite impossible to present over-charge occasionally, it would be interesting to hear other engineers' views on the subject.

F. H.

Ourselves in Trouble.

After reading your account of the opening of the London County Council conduit, I feel it my duty as a member of the electrical profession to say that in reference to one point in your article it speaks of the difficulties at the points and crossings. You say in your article that the troubles of the lights going out, and, to use your own words, they have to use muscular strength or the assistance of another car to get by these positions; when you or any one say that this cannot be avoided, Sir, I tell you or any one it is a false statement, as an inventor of a new shallow conduit, with the one object of my invention of means provided to pass any car or train over those positions, which you say is an impossibility.

I tell you, Sir, as an Englishman, I am ashamed of my country; there is not an electrical journal in the British Isles who will voice a real invention that has been accepted with Royal Letters Patent. What he has to do is to send it through the American Patent Office; then, on strange ground, the stranger is welcomed, and full justice is done to him. I sent you a copy of my complete invention, and I will not repeat your words, as you know full well the contents of your letter. How is it possible for the English people to know what is being done if gentlemen like yourself will not give them an article upon their inventions if they are prepared to pay for. You say it will be a pleasure to do so, but only to the few. I will say, once more, that I, prepared to meet any gentlemen, or the world, and say it is not an impossibility to pass the tram or train at the points yet as you report in your Electrical Review. I will tell you just of late I have met electrical experts who have just returned from America and the Continent, and they, as real Englishmen, say it is a reality for a complete electrification of the present steam roads, with all its difficulties with my system. As for light tramways, the troubles are nothing compared with the steam roads.

I hope you will excuse my plain words on this point. As an engineer of 20 years' experience and four years' close study of this important subject, I should know a little of what I am talking about.

J. F. Smith, *Electrical Engineer.*
Patent No. 22,280, 1902.

Small Heath, *May 18th*, 1903.

[! ! !—Eds. Elec. Rev.]

Poulsen Telephonograph.

Can anyone inform me what has become of that remarkable phonograph, the electro-magnetic one of Poulsen, about which we heard so much some time ago? So far as can be gathered from a search of scientific journals nothing has been heard of it for over a year.

Consulting Engineer.

A "Shocking" Leak.

Your correspondent's account of the above brings to my mind a similar case which came under my notice some years ago.

A main steam pipe, carrying steam across an open space, was drained by a ¾-in. pipe, which ran parallel with it for about 10 ft.

One frosty night this drain pipe, having become full of water, was frozen and burst all along the seam, and when it had thawed, steam issued from the seam with considerable force.

I then noticed a pale blue light in the jet of steam about 2 in. off the pipe, very similar to the discharge of a Wimshurst machine.

The "leak" was considerably heightened in effect by the fact that it occurred in the early hours of a very frosty January morning.

Unlike your correspondent, I was quite content to watch it—"seeing is believing."

At the time I put it down to static electricity caused by the friction of fine particles of steam in the air.

Henry S. Whiteley.

Huddersfield, *May 24th*, 1903.

In your "Correspondence" columns of 22nd inst. I see that Mr. D. M. Nichol has met with a phenomenon in his experience similar to mine.

I am an electrician in charge of an installation consisting of three high-speed engines and dynamos coupled direct.

At the time of my discovery I was charging the battery, and in walking on to the boilers, stepped on to some wooden planks near the safety valve, steam blowing on to my leg; on touching one of the valves I received a

slight shock; at the same time noticing a spark about ¼ in. long. I stepped away from the steam and could feel nothing. I naturally expected to find a bad leak on my circuits, and stopped the machinery and cut off the battery, but on testing my plant I found the insulation was good.

The phenomenon at that point still exists. By putting a steel rule, one end in the steam and the other near to any metal on the boilers, a spark ⅜ in. to ½ in. is seen.

This happened with me only this week. I should be glad to hear further on the subject.

W. Reem.

Coalville, *May 23rd*, 1903.

Electricity in Mines.

Referring to the report of the evidence taken by the Committee on Electricity in Mines in this week's issue of your journal, may I, as an electrical engineer, who has devoted considerable attention to the transmission of power in mines and collieries, and who has had many opportunities of discussing and appreciating the views of mining engineers, make a few remarks anent some of the evidence and, particularly, Prof. Thompson's opinion of high pressure circuits in shafts and adits?

The writer understands that pressures of 2,000 virtual volts and over have been taken underground in foreign mines, but his experience is, that 600 virtual volts is quite high enough for such a situation, when considering the safety of human life.

In few instances, is it possible to fix cables in a shaft, or drift, where there will be a complete absence of traffic, of water, quantities of coal dust, or uptake air impregnated with acid moisture. Such main cables are usually fixed in winding shafts, where men are constantly travelling up and down in the cages and outside them for purposes of examination, so that mining engineers, while employing the very best qualities of armoured cable, will, doubtless, hesitate to instal pressures higher than that mentioned, even where the cables themselves are to be further protected from mechanical injury by casings of wood or iron. The dangers attendant on such mains are very obvious. In combined winding and pumping shafts, the risk of damage from accidents to cages, trams, guides, pump-rods, bursting of rising mains and from steel ropes running in such a shaft for haulage purposes is very great. Few engineers would, for an instant, entertain the idea of a 1,000-volt main passing down a drift along which miners may travel daily, and, as has occurred within the writer's experience, assist themselves in walking up the engine plane by grasping the power cable. It is not too much to say that there are, perhaps, few situations less favourable to the employment of high tension than those indicated.

The first witness, Mr. A. Siemens, is reported as advocating a limit of 500 volts at the face, and I venture to think that 500 to 600 volts is a reasonable value for such a position—with the present appliances. There are, however, many collieries where motors or lights at the faces would be an impossibility. In this connection it should not be overlooked, when comparing the direct-current and three-phase systems from a point of view of safety, that an element of considerable danger, in fiery mines, lies in the switches controlling a coal-cutter, pump, or other motor near the faces. I cannot help thinking that there is very little to choose between the two systems under this head, as the commutator of a well-constructed direct-current motor may be rendered just as gas-tight as the starter of a squirrel-cage induction motor.

The writer thinks there are many objections to the use of transformers under ground. These would not be necessary with pressures of the order of 600 volts at the pithead, and he believes this is the figure approved by the majority of mining engineers.

All switches, fuses and junction boxes should, in my opinion, be constructed in such a way as to render the communication of a slight explosion, originating at the contacts, to the surrounding media, impossible. Such apparatus would not necessarily be gas-tight, but the protection would be designed on the principle of the safety lamp.

As to the abuse of fuse wires. This is out of the question in the case of a well-ordered installation, and, in all cases, one or two responsible persons should alone have access to them. It may be interesting to mention that the suggestion, made before the Committee, to group fuses in banks and place them under lock and key is the plan adopted by the firm which has, perhaps, carried out the most extensive mining installations in this country. The writer refers to Messrs. Scott & Mountain, of Newcastle. The electrician at the mine, and the under managers are, in these cases, the only persons with access to the fuses, and standard spares are carried in the switch-rooms.

I am in agreement with Prof. Thompson in thinking that underground voltages should be limited by no inflexible rule, but at the same time, think that mining engineers, while employing high tension currents for surface transmission, and thoroughly appreciating the great economical importance of electricity applied to their peculiar requirements, will reject, for the present, the notion of such circuits in the mine itself, even assuming that intelligent associations of labour made no protest against their use.

May I hope that some of your readers, amongst whom there are many mining engineers and managers, will find the time to discuss the subject touched above with greater ability than is possible to an electrical engineer?

Adolphus B. Croft.

Cardiff, *May 19th*, 1903.

LEGAL.

Chamberlain & Hookham *v.* Bradford Corporation.

(*Concluded from page* 860.)

On Friday, May 8th, Mr. Cripps, continuing his argument for the respondents, said he desired to refer to the evidence given at the trial on behalf of the appellants by Mr. James Swinburne. Shortly that witness gave evidence on five points. The first was that by a current meter, only quantity was measured—that was really a question for argument hereafter; the second was as to the two parts of the motor—the motor and the brake; the third that each followed the correct law, and as to those two the evidence was all on common ground; then fourthly, how to reduce friction without reducing power and thus altering the necessary relation between the two, and as to that the Witness thought the defendants got over the difficulty in another way to the plaintiffs; and fifthly, the brake which had to be constant and effective. The learned counsel having read the evidence,

The Lord Chancellor remarked that practically the sole question on which the appeal rested was infringement, and added "you say we have not infringed." There is, if you prove that, an end of the matter, unless you think it necessary to go into the question of the validity of the patent. If there is no infringement, then we have done, speaking generally of the whole combination, only that which everybody has a right to do, through the previous statements of how the thing could be done, namely, the permanency and the constancy and the mode by which in that respect currents were measured. There is nothing that you say is new in the motor of the appellants'—it is any form, and the patentee says himself any known motor may be used. If the constancy and the operation of that constancy and power in using these Foucault currents which is itself also laid down in the previous discussions—if that question is so disposed of, what is the thing taken from him which he is entitled to claim as his own?

Mr. Cripps replied that shortly the respondents whole case was—that they had done nothing in respect of which they were indebted to the plaintiffs. As to the magnet, the appellants had put themselves out of Court, because the respondents' instrument was a different instrument, depending on different laws. The learned counsel then explained the two magnets, and said that in Hookham's patent you had a built-up magnet. Having concluded reading the evidence of the appellants' witnesses, he said he had gone through it at considerable length, because he submitted that the evidence relied on by the appellants clearly established that the respondents had not infringed.

Mr. Bousfield followed on the same side. Whether the appellants' case was looked at from the construction of the claim, or having regard to what was the opinion of Mr. Justice Farwell that Hookham really invented something ingenious, this appeal could not succeed.

The Lord Chancellor: But Mr. Hookham might say these were all theories which have been propounded, but the first person who made a real motor-meter was myself, and nobody else had made one up to that time.

Mr. Bousfield: Even so. How far does that carry him as a matter of law? Perhaps I might crystallise the knowledge if I

take my friend's diagram. All that was shown by that picture was known before the date of Hookham's patent. When I say all that is shown, I exclude the point of the silver commutator, which was not known; I exclude the controversy about the constancy and power of the magnets. It was all fully described in Deprez and in Ayrton and Perry. That was common stock knowledge at that date; common knowledge from which he or we may start. I know of no principle of law by which, supposing a man does stop short of being practical at that point, that by reason of some discovery about friction or something of that kind, and because he first makes it practicable, he can appropriate to himself all that which was the common stock of knowledge on the point so as to prevent somebody else getting in and in another way making it commercial. That argument is utterly independent of what the construction of his claim may be. We say that our evidence shows that all that we stopped short of was showing how to get rid of friction in a practical way so as to make a commercial meter. There was the strong evidence of Prof. Ayrton, which was convincing, on this point. What does Hookham indicate? Very ingenious things—commutators of a certain sort in which particular ingenuity is possible in bringing his sectors horizontal. Then he adopts arrangements with reference to friction and power, and, of course, new arrangements; but he brings them in, and by those arrangements he gets over friction. He also devises very powerful magnets, and points out that if you have a peculiar form of magnet with very large surfaces close together you get a large driving power, and you also get a correspondingly large breaking power. We started from the same point, but we go more closely on the line which has been already indicated. We had the silver commutator, which gets over the difficulty of friction at once. We also used permanent magnets of the shape which it was admitted by Mr. Swinburne and by Hookham was a very ordinary type of magnet at this date, although the particular type had not been applied to an electro-meter. The claim consists of two elements, a motor having constant field and a brake having constant field. Hookham is devising a motor with a constant field, and he makes two claims as to how he is to get it. First of all, a very special form of permanent magnet with splayed pole-pieces, which if he can keep it constant, will be a motor having a constant field, and a claim preceding that is for magnetising an electro-magnet to saturation, and he claims it.

Lord DAVEY: He claims it as constant whatever may be the changes in potential.

Mr. BOUSFIELD: Yes. First of all he gets it by not having the potential in his field. The other method was by having a magnet saturated to such an extent that however the current varied and however the potential varied the magnet was always saturated. It was a fight over the question of construction. Then as to the other claim, Mr. Astbury had developed the argument as to that boldly, but passages in the evidence showed beyond all controversy that whereas the wide splayed-out pole-pieces were good for driving, they were the very worst form of brake.

The LORD CHANCELLOR: Will you refer me to one passage of that sort?

Lord DAVEY: The precise passage in which he suggests he could use them as a brake.

Lord SHAND: The argument was put that Mr. Swinburne had admitted that.

Mr. BOUSFIELD: First of all, Mr. Hookham admits it in his evidence. [The learned counsel then read passages from Mr. Hookham's and Mr. Swinburne's examination.]

Lord DAVEY: I should like to hear you, Mr. Bousfield, on a point to which the Court of Appeal seem to attach importance, that Hookham's magnet was a built-up magnet.

Mr. BOUSFIELD: That is a question of construction. He says: "In place of electro-magnets as described and represented, I prefer using for smaller installations permanent magnets." He is going to describe the change he is about to make. "A number of bar magnets being substituted for the electro-magnets represented in the drawings." My friend also relied on these words, "Though I may use magnets of other shape or configuration." What does all that mean? It means, instead of bar magnets with straight lines, he may have magnets of other shapes, and a very good illustration of that was the case of Hookham *v.* Johnson. There he piled up a number of magnets that may be in the shape of a horse-shoe. This claim as regards magnets, consists in the substitution of this built-up magnet—that is a number of bar magnets being used. They may be horse-shoe magnets, but this invention, so far as this form goes, we submit consists of the substitution of a number of magnets on which he then puts all these big splayed-out pole-pieces.

The LORD CHANCELLOR: Nowhere in the specification does it say as a scientific fact that either for braking, or for motor purposes, the splayed magnets are the thing that he prefers.

Mr. BOUSFIELD said Mr. Hookham did say that was so, and that his statement was the passage, and the only passage, Mr. Astbury relied on in the whole specification to support the view that he was contending for, that they were claimed to cover the case of the brake as well as the magnet.

Mr. ASTBURY having replied,

The LORD CHANCELLOR said they would take time to consider, and would give judgment at a future day.

BRITISH ELECTRIC STREET TRAMWAYS, LTD.

In the Chancery Division on Tuesday, May 26th, Mr. Justice Byrne again had before him the petition of Mr. A. J. Paine for the winding-up of this company.

Mr. BUCKMASTER, K.C., said the petition was that of fully-paid shareholders, asking for a compulsory order against the company, which was in course of voluntary liquidation. The petition had stood over from time to time and terms had now been arranged upon which the petitioner consented to the petition being withdrawn, and he (Mr. Buckmaster) understood that all the parties who had given notice of their intention to appear on the petition, to oppose or support it, consented to this course being adopted without saying anything as to costs.

Mr. McKlein, K.C., Mr. Younger, K.C., Mr. Macnaghton, K.C., and Mr. Martelli, appeared for the other parties.

Mr. Justice BYRNE allowed the petition to be withdrawn accordingly.

SADDLEWORTH URBAN DISTRICT COUNCIL *v.* BINNS & MARIAN. THE SPRINGHEAD URBAN DISTRICT COUNCIL *v.* THE SAME.

THESE actions came before Mr. Justice Darling, in the King's Bench Division, on Saturday, two actions by the local authorities to recover in the first case £762 1s. 6d., and in the second £658 2s. 6d., the amount of their costs in connection with the promotion of a Bill in Parliament and with obtaining an order from the Board of Trade for a system of tramways and electric lighting stations.

It appeared from the statement of Mr. MONTAGUE LUSH, K.C., for the plaintiffs, that the defendant Binns was the promoter of the Bills, and he entered into two agreements with the local authorities, on May 7th, 1902, by which he undertook to pay the costs and expenses incurred by them in relation to the matters in question. By a bond dated January 1st, 1902, the second defendant Marian agreed to pay £250 towards the costs incurred.

The defence was that on the construction of the bond certain provisions had been made as to the time of payment, which, according to the bond, was to take place either upon the completion of, or discontinuance or withdrawal of, the proceedings taken for introducing the Bill, or upon the construction of the tramways. Defendants alleged that there had been no discontinuance or withdrawal of the proceedings, and the tramways had not been constructed, and consequently the time for payment had not come. In the result his Lordship gave judgment for the plaintiffs for the amount claimed in each action.

PATENT EXPLOITATION, LTD., *v.* THE AMERICAN ELECTRICAL NOVELTY AND MANUFACTURING CO., LTD.

THIS case was opened before Mr. Justice Buckley in the Chancery Division on Friday last, May 22nd. It was an action to restrain defendants, their servants and agents, from the alleged infringement of the plaintiffs' Letters Patent No. 1,110 of 1890, damages and consequential relief. The statement of claim alleged that the plaintiffs are the legal owners of Letters Patent No. 1,110 of the year 1890, granted for the term of 14 years from January 21st, 1890, to Chas. Addison Hitchcock, for a new invention entitled "An Improvement in Galvanic Batteries." The particulars of breaches alleged that the defendants had infringed the plaintiffs' patent by selling to divers persons batteries and cells made in the manner described in the plaintiffs' specification.

By the statement of defence, defendants did not admit that the plaintiffs were at the date of the writ in the action the registered legal owners of the letters patent; denied infringement and alleged that the said letters patent were invalid by reason of prior publication of the invention. Defendants alleged that the said invention had been published in this realm prior to the date of the letters patent by Winter, No. 2,637 of 1874; Newton, No. 4,719 of 1880; Walker, No. 1,833 of 1883; Webb and Jensen, No. 1,938 of 1883; Abel, No. 1,929 of 1887; Dymond, No. 17,238 of 1888; Dymond, No. 18,754 of 1888; Smith, No. 2,297 of 1889; Arnold and Corgell, No. 9,153 of 1889; Thiebaut (French), No. 142,524 of 1881, and additions, April 3rd, 1882; Bender (German), No. 48,695, dated December 9th, 1888; Roberts (American), No. 369,090 of 1888; by publication in Prof. Silvanus Thompson's work, "Elementary Lessons in Electricity and Magnetism," 1882; by the deposit in the Patent Office of Delahaye's L'Annés Electrique Deuxieme Année, published in France in January, 1886; by the common use of sawdust, plaster and other suitable materials for fixing the liquids used in galvanic batteries, and by the common general use of a depolarising agent in mixture with the exciting agent in contact with the negative electrode. Defendants further pleaded want of subject matter.

Counsel for plaintiffs, Mr. Astbury, K.C., Mr. A. B. Shaw and Mr. Paget (instructed by Messrs. James, Mellor & Coleman); for defendants, Mr J. Fletcher Moulton, K.C., Mr. A. J. Walter and Mr. J. Hunter Gray (instructed by Messrs. Wilson, Bristows and Carpmael).

Mr. ASTBURY, K.C., in his opening speech said the action was on a specification of Letters Patent, which his Lordship had had before him in an earlier case, of one Hitchcock for a dry battery, and the defendants were a new company whom they were suing for infringement. With the exception of a few further particulars of objections that the defendants had managed to discover in the meantime, the principal difference between this case and the last was the question of infringement. The infringing battery was not quite the same as before. Plaintiffs' patent was for a dry battery, made by filling up the space between the two electrodes with two layers of material according to a prescription which might be varied in certain ways, as stated in the specification. His Lordship when the patent was last before him came to the conclusion that pulverisation was the novelty in the combination claimed, but that plaintiffs had not sufficiently claimed it in their specification. The specification did present certain difficulties. The Court of Appeal, fortu-

nately, for plaintiffs, took a different view about the pulverisation, and held they had sufficiently shown the necessity of it to have impliedly incorporated it in their claim. With regard to the anticipations pleaded in the last case, the learned counsel did not recollect that his Lordship had definitely decided that any one or more of them was an anticipation. His Lordship's view was that the claim was so wide as to more or less claim what was shown in the previous documents, and he held in plaintiffs' favour on the patent. Proceeding, the learned counsel referred his Lordship to Hitchcock's Patent, 1,110 of 1890, and submitted that the invention was not one for making a battery, but was an invention relating to a battery constructed and arranged in the way the patentee described with reference to certain drawings. There was a cylinder of zinc or equivalent metal forming the one electrode with the clamping screw. The rod of carbon in the centre was the other electrode. The cylinder A was lined with an exciting agent. The patentee called the whole of a certain compound which he gave a prescription for, an exciting agent. That disintegrated the zinc and caused the current. His Lordship would have to construe what "preferably of the following ingredients" meant. They were not tied down to the exact chemicals given, nor were they tied down to the exact proportions. This was the best prescription the patentee knew. "Lined with an exciting agent, E, consisting preferably of the following ingredients, viz., sal-ammoniac one part"—that was the excitant—"chloride of zinc one part"—that was the hydroscopic"—"plaster of Paris three parts"—that was the filtering agent—"and water two parts, to which is added a little less than than one part of a comminuted vegetable material, preferably flour." The patentee then said: "For preparing the exciting agent, E, the materials are mixed, forming a semi-fluid, which is poured into the cylinder, A, around a central core, temporarily inserted. The exciting agent soon sets to the condition of a semi-solid, and the temporary core is removed. The carbon, C, is then inserted centrally in the space left by the withdrawal of the core, and the space around the carbon is filled with a compound consisting preferably of the following ingredients:—The excitant sal-ammoniac, the same as before, one part chloride of zinc, or other hygroscopic analogue, one-tenth part." His Lordship would notice that the patentee had altered the amount of his hygroscopic in his inside mixture—the mixture which was to depolarise the battery. He had been careful to provide for a lesser amount of the damping material in the inner layer, which would get more moisture by the action of the battery than the outer layer. "And as depolarising agents pulverised peroxide of manganese three parts with pulverised carbon 3½ parts." The Court of Appeal took the view—two judges out of three (the third Lord Justice, Lord Justice Cozens-Hardy, gave it a wider construction even than plaintiffs' asked for)—that the preference there related to the ingredients, and not to the manner in which these ingredients were to be preferably used. Proceeding, the learned counsel said that in many of the earlier batteries they used acids—nitric acid—for a depolariser. His learned friends in the Court of Appeal had argued most strenuously that there was nothing in this specification to exclude the use of acids as depolarisers, and they cited thereon a number of acid batteries which they said had been filled up with things like fibrous matters, cellulose and paper, and other things to make them dry. They said those were anticipations. The Court of Appeal said: "No, this battery has been limited to a battery in which you get an insoluble powder for a depolariser." In the second compound, sal-ammoniac was soluble in water at once, and so was chloride of zinc. The Court of Appeal said there was nothing else in the mixture but what were to be the two depolarisers. Once exclude an acid and a semi-solid could not be formed by taking two lumps of something which was insoluble and mixing those lumps with water. In the old Leclanché battery they had lumps, grains or pieces of manganese, with a direction that you must throw away the dust. The Lords Justices came to the conclusion that there were not sufficient directions here—that you must have your depolariser an insoluble solid, and that the insoluble solid must be ground to such a fineness as that, when mixed with water, it would make a semi-solid by holding up the water by capillary attraction. The specification said the materials mentioned as electrodes, and as exciting and depolarising agents, were in two compounds, and their proportions might be varied. The Court of Appeal held that that variation must be a variation within equivalents. In other words, they said that that only meant:—"I have told you my best prescription, but I do not tie myself absolutely to it; you may find equivalents for one or more of these things, and provided the equivalents are for battery purposes, you may use them, and you may also, within limits, vary the proportions for the purpose of getting the functional results of these two layers. The battery that was in the last case called an infringement, was practically identical to that of the plaintiffs—so much so that no evidence was given contradicting the infringement. In the present case there was a variation which, in plaintiffs' opinion was only colourable or slight. Still, there was a distinct variation. What defendants had done was this: They substituted in the other layer blotting paper for plaster of paris and flour. In laboratories plaster of paris and blotting paper were the two best known filters. The old idea in the Leclanché battery, when they went from the one to the two-cell Leclanché, was that they had a porous pot round the carbon with a carbon rod in the centre, and they filled that up with their depolariser as a liquid. The result of the porous pot was that the depolariser could not get through, although the liquid freely passed through. So much were they anxious, in the old days, to have that free porosity to liquid, that Leclanché and many makers of batteries actually said you must not only have your manganese in lumps, but you must throw away the dust, because if you do not, the dust clogs up the porosity of the pot and makes it a less perfect filter. What was the function which plaster of paris played to the flour in plaintiffs' battery? It must be something which will hold in the sal-ammoniac and the chloride of zinc and retain position—in other words, make the layer. If plaster of paris and flour were mixed with water they were very fluid at first. One could pour it in, but a pouring of it in was no essential of the patent at all, because it was only poured in for the purpose of letting it set. The first function of the plaster of paris and flour was to keep the layer where it was intended to stop; the next function was that it must be freely porous to damp and a good conductor, so that the current might freely pass through the damp channel; and, thirdly, it must be something that would take the place of the old porous pot, and hold up the depolariser against the carbon, and not let it come through the zinc. Defendants, in this case, substituted a layer of blotting paper of several thicknesses for the plaster of paris and the flour. They used blotting paper with its proper proportion of sal-ammoniac and chloride of zinc and water to make the whole outside layer. For all functional acts, although at first sight it seemed very different, plaintiffs' witnesses would tell his Lordship, that the plaster of paris and the flour were absolutely identical to the blotting paper. Blotting paper was itself comminuted vegetable matter, and was plastic, in the sense that the Court of Appeal held that plasticity, or semi-solidity, was meant here. He understood that the proportions in the defendants' battery were about 70 to 30 of blotting paper and dampness. The mixture was such that it would stop where it was put. It was the exact equivalent of the plaster of paris and the flour for all purposes except that it did not set. The thing was whether setting, in the sense of crystalline setting, was an essential at all in this battery. It was a curious irony that in the Court of Appeal plaintiffs argued that the crystalline setting was an essential. The defendants in that case, through Mr. Moulton and Mr. Walter, argued that that was ridiculous, and that wood pulp would be just as much plastic and semi-solid, and serve exactly the same purposes as plaster of paris. In the Court of Appeal plaintiffs tried to say that in reading the word "preferably" in the first compound, you must limit the preference to things of which you could take an obvious chemical equivalent. Plaintiffs argued there was no obvious chemical equivalent of plaster of paris, because there was no other matter that would set and still be a porous filter. The Court of Appeal would not have it, and said that "preferably" referred just as much to that as to any other ingredient. Fortunately for plaintiffs now, they had to argue that the Court of Appeal was right. Taking the functions of plaster of Paris when used with any flour in it, the learned counsel contended that blotting paper, with its proper proportion of water, containing, as it did, the rest of the ingredients, was the precise equivalent as far as battery purposes were concerned.

Mr. Justice BUCKLEY: Only you can pour it, I suppose?

Mr. ASTBURY: No.

Mr. Justice BUCKLEY: You want to say that lines 12, 13 and 14 preferably apply to plaster of paris—but you may take something other than plaster of paris?

Mr. ASTBURY: Yes.

Mr. Justice BUCKLEY: But still must not take something that will pour?

Mr. ASTBURY: No.

Proceeding, the learned COUNSEL said that very often a great part of the merit of an invention is ascertaining the feasibility of a particular thing, and then finding a particular way to put that into operation. Once known that a battery could be made like this, and that it gave extraordinary commercial results, it was not difficult to make it. In the last case the evidence was uncontested that this battery had thrown all other dry batteries clean off the market. The sale was enormous. It gave a very strong current for its size, and it would do what no other dry battery ever would do before. It was saleable by people like ironmongers without deterioration. An ironmonger could order a gross of them, put them away on his shelves. When he sold them, they would be perfectly good. That had never been known with a dry battery before. The other things went off in a few weeks or months; plaintiffs' battery did not. It had its proportion of dampness and material so regulated that it was perfectly worked out for long keeping. Once find out that it was feasible, and how to make it, then, as many judges had said, it was very easy to see how one could vary it in many ways, and keep its essence. People who tried to do that nearly always failed. If they really got the pith of the invention, variations of several parts of the combination had been held to be insufficient to take them out of infringement, although the particular variations they did adopt were variations that one could not even read from the document at all. Lord Cairns had said you may have an invention of a combination, say of five parts; you may get the pith of that invention by discarding three of those parts altogether, and putting in something else; but if that invention has taught you how you can get the result, and what you can discard of those five parts, if the Court comes to the conclusion you really have borrowed from the man, and have taken the pith of what he invented, the substitution of the parts, though they are parts not in any way adumbrated in the specification, it will still, nevertheless, fail a man in attempt to get out of infringement. The question for his Lordship was not whether he could find blotting paper mentioned in the specification, but whether he could find enough to exclude it, and if he could not, and he decided that defendants took the essence and got the benefit of the invention that was there described, then they infringed. The learned counsel then read at length the judgment of the Court of Appeal in the former case. If they took the Leclanché battery and put the agglomerator up against the carbon poles, and put it on bells and started ringing, it would get fainter and fainter until it stopped.

Mr. WALTER: No.

Mr. ASTBURY said it would be found that it polarised quicker than it depolarised. They might get a Leclanché in which the polarisation would take days or months; but still, as a matter of

fact, the gas in time would overtake the formation of oxygen because they had a strong surface of carbon pole, and they had an active surface of manganese up against it. He believed himself, as far as he could judge, that the secret of the great success of the plaintiffs' patent was that you had the extension of the carbon pole in and around every bit of powdered manganese, so that every particle of manganese, not merely the edges, touched the pole. No polarisation ever began at all, it was checked in its infancy, and never got the slightest chance of affecting the efficiency of the battery. By means of the pulverisation they halved the distance that the current had to pass through something that was more or less solid. Every bit of stuff that the current had to pass through, especially if the battery were a dry battery, was so much absence of conductivity, so much retarding conductivity. It was exerting the battery to make it go through an inch if they could conveniently let it go through one-sixteenth of an inch. The outer layer in practice, both in defendants' and plaintiffs' was only about an eighth of an inch; the whole of the rest was filled up with powdered manganese and carbon. The result was, they really extended the cathode right up to within one-eighth of an inch of the anode, with a material between that prevented any filtration through of the depolariser, but permitted the free filtration of the dampness and the current. That was probably the reason why these had succeeded, where all other dry batteries had failed. Proceeding, the learned counsel said the defendants in this case had taken much to heart the question of pulverisation, because they had been searching about, and they had managed to rake up one or two old documents in which pulverisation was referred to. Fortunately for plaintiffs, they happened to be documents of a very early date, and long after the date of those documents pulverisation had come to be regarded by makers of batteries as something they must avoid. Defendants referred to one in 1866. There were no combinations anything like plaintiffs' patent even if pulverisation were directed, but defendants had managed to rake up one or two ancient documents in which they did find pulverised manganese. Whether defendants were going to add that to their mosaic, which had failed up to now, remained to be seen. Leclanché was a great battery maker, and he expressly directed people and the world, that you must not only not pulverise, but even if you ground the stuff fairly fine into grains you must throw away the dust. What defendants before tried to rely on was a passage in one of Thiebaut, in which he said you need not throw away the dust, as is usual in the Leclanché batteries. Thiebaut was not an anticipator for other reasons. The object of Newton's patent, 1880, which was relied on in the last case, was to render batteries in which the electric current was excited by a liquid portable and available for general use. This was to be done by enclosing the carbon and zinc plates of the batteries in some fibrous or spongy substance, preferably asbestos or spun glass. Shortly put, Newton was simply a patent for stuffing sponge, or something of that kind, into a Leclanché battery. That was practically all it said. Webb and Jensen's patent was a great deal relied upon in the last case, and was again being relied upon. Thiebaut was a case in which a Frenchman took out a patent in two editions. Defendants relied not only on Thiebaut on his first and second editions, but it turned out there was a third edition. The man was not even satisfied with his second. The fact was these documents were all deposited at one and the same time. Of course that made defendants' case all the worse. If they were going to say that a particular document was an anticipation, it was a little awkward for them when the particular document that they were relying on as an anticipation, was given up as something hopeless by the man who wrote it, and he put in a third document showing how to make it when the second one would not work.

Mr. Walter: I do not feel the difficulty.

Mr. Astbury: You felt it in the Court of Appeal.

Mr. Walter: Never.

Mr. Astbury: You talked enough about it. Proceeding, the learned counsel said the patent of April 26th, 1881, by Thiebaut, had only one layer, consisting of potash, plaster of paris and peroxide of manganese, and the peroxide was directed to be pounded, and the dust produced by the crushing retained. The mixture was placed in a cup, the carbon placed in it so as not to touch the cup, and the space that remained filled with the mixture, upon which a little water was then poured. The specification stated that at the end of an hour the element could be carried about, and at the end of a week a hammer had to be used to destroy it. His Lordship would see how hopeless this invention was. In his patent he was going to fill up the whole space between his carbon and his zinc with his depolariser. He not only was not going to provide anything to keep the depolariser away from the zinc, but he put the depolariser right up against the zinc. That was perfectly hopeless. Then he said the thing will be so hard that if you will only wait for a week it will do no harm, because then you will have to take a hammer to break it. It was quite obvious that that would give no current at all. The first edition was the one the defendants relied on. The question was whether anybody who had seen the patent would think it necessary to go further. The learned counsel having concluded reading the judgments of the Lords Justices Vaughan-Williams, Stirling and Cozens-Hardy in the previous case, the Court rose, and the further hearing was adjourned.

(To be continued.)

Foote & Milne v. St. Helens Cable Co., Ltd.

(Concluded from page 862.)

Resuming on May 11th, the cross-examination of Mr. Heyl-Dia was continued by Mr. Spencer Bower, whose energetic methods of questioning are in singular contrast to his leader's quiet searching manner, and as many of the questions travelled over the same ground they are not here repeated. Considerable friction arose between witness and counsel, the former strongly resenting and protesting against the same questions being put, the manner of questioning, and in one instance the mode of referring to him as "a person." He had told Mr. Milne that he could not expect anything better for his money in the 300-grade cable. The rubber is shorter in it than in the 600-grade. He denied that he had ever told him that a batch of bad cable might have got passed. Messrs. Foote and Milne stated what was not true if they said that they had mentioned damage to their reputation at his interviews with them. Liverpool was mentioned, but they did not press it. He had replied that if the workmanship was all right they need have no fear of the cable. At the interview of February 3rd, 1902, he had been shown no tests of Faraday House, and he had never said, "Ah, at any rate, we can make some good wire." He knew now that there had been letters before that date, both with regard to the job at Liverpool and about damage to their reputation. There had never been less than one tester and two assistants at the works. "Bob" was the tester from the beginning until Bartlett's time. Twelve hours' immersion tests in water were only resorted to in times of rush and before their accommodation was extended. No testing books were kept of rubber-covered cables, and he saw no reason now for beginning their use, as they had sold hundreds of thousands of pounds' worth of cable without any trouble resulting. Mr. Heyl-Dia then gave a more detailed account of why he had ceased to be managing director of the St. Helens Cable Co. Before the middle of last year there had been practically only two directors—himself and Mr. Glover, and he had had the casting vote. The debenture holders had appointed a new board, consisting of Colonel Pilkington, his brothers, Mr. Beecham and Mr. Glover. At this time he was struck down with rheumatic fever, due to overwork, and when he came back they told him that they did not want him to do too much. They had made a re-arrangement, and they would be glad to have him as an expert on an engagement for three years. The new terms were more agreeable to him than the old. Returning now to the agreement with Foote & Milne, he maintained that he was squeezed, cornered and coerced into signing it. Mr. Glover had also thought it better to settle the matter out of Court. He maintained that plaintiffs had deliberately mis-stated the charges for work done. He pointed out that wires had been pulled out without testing the circuits to see whether they were bad or not. The charges he made against them were three:—(1) Charging for work which they had no right to charge for. (2) Charges on cable which was not St. Helens make. (3) Delivering to them a large quantity of cable which was not theirs. At this point the friction between counsel and witness drew to a head, the former urging Mr. Heyl-Dia to give his definition of the word "fraud," as applied to the plaintiffs. His Honour interposed, however, in a peremptory manner.

Counsel: And this is the only explanation you can give for the odious charges you bring against the plaintiffs? Witness again gave the same details. Continuing, he said that Holmes was quite an inexperienced hand—at the time no more than an office boy. Witness was shown his letter in which it was stated that the storekeeper would be sent, and was asked how Messrs. Foote & Milne were to expect an office boy instead. It was then put to him that the only difference in value that the use of 600-megohm grade cable throughout the tobacco warehouse would have made would have been £9 10s., and this figure was accepted.

Re-examined by Mr. Terrell, Witness stated that as a rule defects in cables are shown after immersion in water in less than 10 minutes. The 24-hours' test was a test of greater security. Faulty cables were sent back to the fault-finding room, where they were run on to a drum, the end nearest the core being electrically connected to a testing set. As the wire was being run on, it passed through the hand of the fault-finder, who held a wet rag about it, this being connected to the testing set. The result was that whenever a faulty bit of the cable came in contact with the wet rag a fault was indicated. The cable was then cut in two and each part re-tested. He knew and had seen every cable works in this country, and in none was there a more extensive fault-finding plant than in the St. Helens works. Fifteen per cent. of the coils were generally turned back. As regards proving that the cable was at fault, it would have been easy (though defendants had not done it) to get an expert who would have proved what was the matter with the insulation if it was at fault. Other makers used about the same percentage of pigment as themselves. He had analysed other makes and knew this to be so. The same would have been done with the cable in question. In connection with the agreement they were to pay for damage done by alleged bad cable supplied by them. Finding that other makes of cable had been used they departed from the agreement. During the time this cable was being made about 70 miles a week of 300-megohm grade cable was being turned out. They had had other complaints than those mentioned due to the use of 300-megohm grade cable in iron tubes. With the Simplex tube they were especially cautious about contracts, and would not guarantee anything. The use of Simplex tubing, in his opinion, and he thought others would agree with him, was a danger.

Mr. Chandler, storekeeper with the defendants at Warrington, then gave evidence of having carefully sorted out from the cable sent back by plaintiffs that which was not of their manufacture. He had made out a list and brought some samples, both of which were produced.

Mr. Manning, of the accountant's department of the defendants, gave evidence with regard to a list of the discrepancies between cable sent to plaintiffs and that which they had returned.

Mr. Terrell: That will be my case.

The Referee asked if the defendants' man, Jackson, who had made a test of the Belgrave Hospital wiring, and found it low, was not going to be called, the answer being in the negative.

Mr. TERRELL, in stating the case for the defendants, said that he had kept it down to the tobacco warehouse, and if the Referee came to the conclusion that the cable was at fault there, the other instances would follow that ruling. They had contracted to sell plaintiffs 300 and 600-megohm grade wire, but they had not contracted to sell it for use in any particular manner. So long as it passed that test after 24 hours' immersion in water, that was all that was implied. A grade means quality of rubber, quality of rubber means durability. Each grade is divided into various classes, and these are divided into three classes of different coverings. The use of 300-megohm grade in such a place as this tobacco warehouse was an error, and he contended that the tests showed it to be so, since while they were good at first, they rapidly fell, showing that too low a grade of cable had been used. The plaintiffs to prove their case should have brought up an expert chemist or cable maker, such as Mr. Christian Gray or any other expert, who would have told them what, if anything, was the matter with the rubber. The whole point of the grading was to differentiate between the durability of the grades. If 300 m. grade was as durable as say 1,000 m. grade, there would be no use in manufacturing the latter, since as high resistances could easily be got with the former. Taplin said he expected to get 600 m. grade cable, and he was the man who had made out the specification. Everything was done in the cheapest way, and with none too skilled workmen. If 600-megohm insulation resistance per mile did not mean 600 m. grade cable, it meant nothing at all, as the very commonest cables in the smaller sizes would give this insulation resistance. Counsel then reviewed the tests. Passing on to Mr. Heyl-Dia's evidence, he pointed out that the agreement was broken, because rightly or wrongly, Mr. Heyl-Dia had got it into his mind that plaintiffs were trying to "do" him. He (Counsel) thought that there were no indications in this case to show that plaintiffs were at all guilty of intentional deceit. Had the insulation of the cable really been bad, defendants would have had numberless complaints, as they were turning out similar stuff at the rate of 70 miles per week. He contended that the plaintiffs had not discharged the obligation of proving that the defendants were liable for the large sum of damages which were claimed in this case. He then went into the matter of some minor costs which were in question; as for the claim of damages to reputation, that was founded upon the construction of the agreement, which would be for his Honour to decide.

Mr. HAMILTON, K.C., in stating the plaintiffs' case, went into the subject first as a story of three chapters. Chapter 1.—A manufacturer who makes cables with warranties and the usual obligations to supply an article decently fit for its purpose. A contractor who relies on the warranties. The officers of the work done, who, one and all, come to the conclusion that the fault of the installation is the fault of the cables, and condemn them. Chapter 2.—The managing director of the cable company signing an agreement, with the provisions that if he did not keep rigidly to them, he would become liable to pay the costs incurred and damages to reputation. Chapter 3.—The agreement broken, and a lawsuit the result. The one chance of proving the cable good was to call for the actual makers. This was not done, only a director being called, who refuses to admit that his wire was at fault, and maintains that the plaintiffs coerced him into signing an agreement acknowledging that it was. The one person who did make a test of the cable outside the works is not called, and his report has been destroyed. Everything is wrong except the cable, is the answer. Had that story been told to a business man, counsel contended, the answer would be assured.

Resuming on May 12th, Mr. HAMILTON reviewed the scientific evidence scathingly. The use of 300-m. grade cable was said to be at fault; but why did the 600-m. grade break down, and why did the latter break down at Belgrave Hospital also? Then, again, 300-m. grade of Henley's make has since been used, and is satisfactory. Frankenburg cable is said to be at fault; but this cable has been tested and proved good. It was certainly not good law to say that the warranty only held to a test in the works. According to the Sale of Goods Act, the thing offered must be marketable and fit for its purpose. It must have a reasonable degree of durability. The Simplex tubing was said to be coarse, but this was specified for, and it has since been used with no bad results. Robinson's letters were a very slender foundation to raise such inferences on as they had done. It was significant that under the same circumstances the Henley cable had turned out well. The faults of the cable had been proved by the tests not to be faults due to local defects, but to generally diffused unreliability of insulation. Would Mr. Milne have risked an unsuitable grade on such a large job for the sake of £10? Jackson had tested the Belgrave Hospital, yet Mr. Heyl-Dia signed the agreement after that test had been made. The coil of atrociously bad cable produced in Court never came from the plaintiffs. He had learned that such cable was sold for a special purpose by Geipel & Lange, and the defendants dealt with them, not the plaintiffs. That being so the inference was plain. Mr. Hamilton concluded his address by arguing on the legal construction of the agreement, contending that upon it the plaintiffs could sue and recover a round sum for the resulting damage to reputation.

The REFEREE reserved his decision.

On Tuesday, May 26th, the Official Referee, Mr. VERNEY, delivered judgment. He said:—

"After considering the correspondence and evidence brought before me in this case, I have come to the conclusion that the defendants sold to the plaintiffs vulcanised rubber cable at the price and on the terms stated in the price list and subject to the guarantee contained therein, namely, the guarantee of a certain minimum insulation resistance per mile after immersion in water for 24 hours. In my opinion, such a warranty carries with it a guarantee of a reasonable degree of fitness of the article for the purpose for which it was sold. The plaintiffs claim damages for expenses incurred in rewiring various jobs on which the alleged bad cable was used. The question which I have to answer is: Did the defendants deliver cable of the guaranteed minimum insulation resistance? It would appear, and it has been agreed to, that the tobacco warehouse of the Mersey Dock and Harbour Board is the most important item in the claim. The contract for this work contained the specification that all cables used should have a minimum insulation resistance of 600 m. per mile. No grade was mentioned. I find that the cable ordered would have satisfied this guarantee, if the insulation resistance had been according to warranty, whether 300 or 600 m. grade cable. It has also been proved that some Frankenburg cable was used. There is no doubt that the installation broke down, and that the Dock Board required plaintiffs to remove it. Was the cable in fault? Mr. Lyster, Mr. Taplin, Mr. Radcliffe, &c., all independent witnesses, were satisfied that the cable was bad."

The REFEREE then went into the subject of Mr. Milne's tests, and also of the tests made by Silver and Marchant, pointing out that they had also found the cable bad, and that the latter had proved that the Frankenburg cable was not at fault.

"After full consideration of the defendants' evidence, I have come to the conclusion there is very strong evidence as to the faulty nature of the cable." The Referee then stated that he was not satisfied that the cables were tested before leaving the works. There existed room for mistakes, he considered, the men and the works both being new. As to the evidence given by Mr. Wordingham and Mr. O'Gorman, he could not accept their statement with regard to the 300-m. grade cable at Liverpool. Taplin had said that if the cable had shown an insulation resistance of 600-m. per mile, he would have accepted it. Radcliffe knew that 300-m. grade cable was being used, and he passed it. Again, the Frankenburg cable, after being withdrawn, had proved good, and now the 300-m. grade Henley cable satisfied the tests.

"It has not been proved that anything was wrong with plaintiffs' workmanship. Henley's cable has been installed and has not been injured, and neither was Frankenburg's. No steps were taken at the time by defendants to ascertain whether the workmanship was at fault." Continuing, the Referee then pointed out that what appealed to him most was the attitude taken by Mr. Heyl-Dia. The cable was made under his supervision, and he was master in the factory. No one knew so much as he did of what went on there. When plaintiffs complained, he took no steps to find out whether the wire was improperly used, but an agreement was entered into to have the wire tested, and bad coils replaced. Plaintiffs write to defendants that defendants' tester had found several coils bad. They reply that Jackson's testing set must be bad. It is quite clear that their tester did find some bad coils, but no evidence was produced with regard to Jackson's set being wrong, nor has Jackson been called as a witness. Having got his tester's report, Mr. Heyl-Dia entered into the agreement (which has already been given in the early part of this report). The whole of the correspondence on both sides, and the whole conduct of Mr. Heyl-Dia, and taking also into consideration the letters of Geipel & Lange and his reply to them with reference to a similar complaint, the Referee stated, led him to the conclusion that Mr. Heyl-Dia knew that something was wrong with the cable. He found, therefore, that defendants had failed to fulfil their contract and that the wire was not of the guaranteed minimum insulation resistance.

With regard to the amount, he considered that Dr. Marchant's fees should be allowed the plaintiffs, and that the total sum would be the sum agreed upon between counsel—namely, £2,577 11s. 5d. The defendants had abandoned their counterclaim, and there would be costs on the claim and counterclaim against the defendants.

As to damages to reputation, he was of opinion that clause 11 in the agreement (*i.e.*, that if defendants failed to fulfil the terms of the agreement the plaintiffs could claim against them for damages to reputation), left it open to plaintiffs to so claim. Throughout the case vindictive damages under this head had not been claimed, but a good round sum had been asked. He thought that it had been made out that such damage to reputation would result and had resulted, and he thought that £300 would meet the claim.

PARLIAMENTARY.

METROPOLITAN DISTRICT RAILWAY (VARIOUS POWERS) BILL.

RECENTLY a Select Committee of the House of Commons, presided over by Mr. Hudson Kearley, considered the above Bill. Mr. Pember, K.C., Mr. Freeman, K.C., and Mr. Clode appeared for the promoters, and the principal opponents were the Metropolitan Railway Co., the London County Council and the Stepney Corporation.

Mr. PEMBER opened the case for the promoters, and explained the objects of the Bill, which he said was to empower the Metropolitan District Railway to deviate the railway authorised by the company's Act of 1870 and to construct other railways; to acquire lands; to lay down electric cables; to raise further capital, and to acquire the Hounslow and Metropolitan Railway. The new lines were four in number, the first commencing at Acton by a junction with the company's Ealing extension and joining the existing railway at Hammersmith; the second was a deviation of a portion of the railway authorised by the Act of 1897 from Gloucester Road to Earl's Court, so as to go under the existing District Railway instead of under Cromwell Road; and the third and fourth were for extending the line from Mark Lane Station to the disused Tower Station.

There was a further small line, 1 furlong 6 chains, in a similar direction. They were also asking in the Bill for powers to transfer to the Great Northern, Piccadilly and Brompton Railway the powers to construct the piece of railway from Gloucester Road to Earl's Court.

Mr. C. A. Brereton, C.E., a partner with Sir J. Wolfe Barry, the engineer to the District Railway, giving evidence in support of the Bill, said that the object of constructing the two pieces of line alongside the existing joint lines between Mark Lane Station and the Minories, was to provide increased accommodation to meet the growing traffic of the joint companies; and, further, to admit the London, Tilbury and Southend and the new Whitechapel and Bow Railway at this point. It was proposed to abolish the existing station at Mark Lane and erect a new one in its place.

Replying to Mr. Balfour Browne, Witness said he did not know whether the Metropolitan Railway Co. objected to the removal of Mark Lane Station, but the District Co. had an equal right in it.

Mr. R. W. Perks, M.P., chairman of the District Railway, also gave evidence supporting the Bill. He said the proposed two lines in the east were simply station widenings and "docks" for the use of the London, Tilbury and Southend Co.'s trains coming from the east, and, if necessary, for some of the District trains coming from the west. It was not until a few weeks ago that he heard of the Metropolitan Railway objecting to the proposals, although they had known all about them since November last.

Sir R. Littler, speaking for the Metropolitan Co., contended that the effect of the proposals would probably be to interfere with and restrict the full development of the Inner Circle traffic, which might be legitimately expected to follow when the Metropolitan was run as an electric railway.

Evidence was given by the general manager of the Metropolitan Railway in support of the contention of the learned counsel. The Committee found the preamble of the Bill proved as far as the new lines at the Tower were concerned.

On Tuesday the proposal before the Committee was the deviation of about 800 yards of the authorised deep-level railway of the District Company between Gloucester Road and Earl's Court. The authorised line was to have been constructed under Cromwell Road, but it was now proposed to abandon that route and to construct it under the existing District Railway between these two points.

Evidence was called in support of the proposal, and Mr. Brereton, C.E., stated that there were no engineering difficulties.

After Mr. E. Pollock had addressed the Committee on behalf of the L.C.C., the Committee passed so much of the preamble of the Bill as related to the deviation.

Mr. Kearley has reported for the Select Committee, considering this Bill as follows:—

That it is not intended that the railways proposed to be authorised by the Bill should cross on the level any railway, tramway, tramroad, or highway. One of the objects of the Bill is to transfer to the Metropolitan District Railway Co. the undertaking of the Hounslow and Metropolitan Railway Co. A certificate from the Board of Trade was produced to the committee, showing that it had been proved to the satisfaction of the Board of Trade in pursuance of Standing Order No. 163 that the Metropolitan District Railway Co., and the Hounslow and Metropolitan Railway Co. had paid up and expended one-half of their respective capitals. In pursuance of Standing Order No. 145A a report from the Board of Trade was laid before the Committee with reference to the tolls, rates, and charges proposed to be authorised by the Bill, and it appears that the tolls, rates, and charges were not in excess of those authorised in respect of the portion of the existing line with which it is intended that the new railways shall be connected. A report from the Board of Agriculture was laid before the Committee, but was not considered by them inasmuch as the Railway No. 1 to which the report relates had been struck out of the Bill laid before the Committee. In pursuance of the resolution of the House of April 28th, the Committee had inserted in the Bill the additional provision referred to in that resolution. There are no other circumstances of which, in the opinion of the Committee, it is desirable that the House should be informed.

Scottish Private Bill Legislation.

On May 6th the Commissioners resumed consideration in the Justiciary Buildings, Glasgow, of the provisional order promoted by the Glasgow Corporation to take over the order sanctioned by Parliament in 1901, granting the Burgh of Clydebank power to construct an electric tramway system.

Mr. John Young, general manager of the Glasgow Corporation tramways, stated in reply to Mr. Crabb Watt, K.C., that the length of the proposed tramways was 9½ miles of single track, half of which was outside the city boundary. No less than 22 per cent. of the original tramways of Glasgow were outside the city. At the present moment the percentage was 35. Clydebank saw that it would be better to have their tramways worked by Glasgow, and they were now in agreement with the Corporation for that purpose. Under their Act, Clydebank could operate the tramways in their burgh, bringing their cars up to the junction with the Glasgow system at Yoker. It would be a great advantage to Clydebank to have the running power to Glasgow. The power on the cars outside the municipality, was the same as inside. A railway train from Queen Street to Yoker would take about 20 minutes on the journey, whereas a tramway car would take 45 minutes. Assuming that the opposition of the railway companies was because of diverting traffic, the Corporation was doing nothing in the present case other than what it had done in other parts of the city. The Corporations of Manchester and Newcastle had received sanction to extend their systems into neighbouring burghs. Liverpool quite recently got power for a through route to Bolton.

By Mr. Cooper, advocate for the North British, Caledonian and Lanarkshire and Dumbartonshire Railway Cos.: The Corporation tramways paid nothing for the use of the streets, and outside the boundary the same thing existed, but the department maintained the streets and gave the service. The North British and Caledonian Railways had each three stations within the Burgh of Clydebank, and immediately outside the burgh, the North British had two and the Caledonian one. There was a frequent service of trains.

Mr. Cooper: May I take it that it is the through service to Glasgow you are aiming at in getting this order?

Witness: We are simply here to get an agreement by two local authorities carried through, if possible, and are quite willing to stand up to our part of our agreement.

Mr. Robert Miller, general manager of the Caledonian Railway Co., was examined on behalf of the objectors to the proposed order. He stated that it was not the policy of the company to oppose the granting of tramway powers when promoted by burghs or the local authorities within their own area of administration. If in 1901 the proposal had been made by the Glasgow Corporation to promote the tramway right down, giving through communication to Clydebank, Dalmuir, &c., it would have been opposed by the Caledonian Railway, because it opened up, for example, through traffic from Yoker to the burgh of Partick. The company were apprehensive that this through traffic would seriously affect their traffic. They had spent, roughly, £982,000 on the construction of the Lanarkshire and Dumbartonshire Railway, exclusive of land. All that they did on the faith of their Parliamentary powers and their relative Parliamentary monopoly. In one district alone the company's receipts had fallen 33 per cent. in consequence of the competition with the Glasgow Corporation Tramways, and he expected this would be amplified if the opportunity were given the Corporation to run to Clydebank.

Mr. Clyde, K.C., addressing the Commissioners on behalf of the railway companies, said that it had been the conviction of everyone that what was wanted in this order was through traffic. As matters stood at present three or four miles of country road would be bridged by a proposed tramway. The bulk of the Clydebank traffic came from the eastern part of Glasgow; and all the talk about pick-up traffic, and the intention to carry short distances as regarded this route of tramways, was simply downright nonsense. The purpose was to connect the works of Clydebank with the working population of Glasgow. This was a case where the railway would be seriously affected, and he submitted that the preamble had not been proved.

The Commissioners found the preamble proved.

Taff Vale Railway Bill.

The Earl of Camperdown's Select Committee of the House of Lords had this Bill before them recently. The promoters were represented by Mr. Balfour Browne, K.C., the Hon. J. D. Fitzgerald K.C., and Mr. Noble.

Mr. Balfour Browne, in opening the promoters' case, said that the Bill was to empower the Taff Vale Railway Co. to construct a short junction line at Willowford, between Treforest and Taff's Well, so as to connect with the completed portion of the Cardiff Railway. The company also sought running powers over the Cardiff Co., and desired to work their railways by electric power. The additional capital asked to be authorised was to the amount of £45,000. The proposed line was at a point where there would be no obstruction to traffic, and his clients were quite prepared to deliver traffic further north at the Treforest junction if required. The principal objection to the proposed junction was that it would take the traffic for about three miles south over the Taff Vale Railway instead of over the Cardiff Railway. It would be an advantage to traders to have an alternative route. The proposed line was 3 miles in length, as compared with 4 miles, the length of the line rejected by Parliament last year.

Mr. George Thomas Silbering, chief engineer to the promoting company, said that the estimated cost of construction was £35,711. Cross-examined by Mr. Ram (for the Cardiff Co.) Witness said that his company did not propose to make any sidings on the new line; all sidings would be on their own line.

Mr. Harland, traffic superintendent, said that the proposed junction would be much more convenient than the authorised Treforest junction. Cross-examined: The junction rejected last year was a more convenient one in respect to interchange sidings.

Sir J. Szlumper, C.E., gave similar evidence.

A number of witnesses were then called, and spoke as to the advantages of the proposed junction.

Mr. Joseph Shaw then addressed the Committee on behalf of the Incorporated South Wales and Monmouthshire Coal Freighters' Association, and called Mr. John Daws, the secretary of the association.

Mr. Pember, K.C., having addressed on behalf of the Cardiff Railway Co., Mr. Fitzgerald replied for the promoters. He said that they had good reason for believing that if the junction were made at Treforest it would only be able to be used for a large quantity of traffic at great inconvenience and obstruction to the working of the Taff Vale Railway. He contended that the only real opposition was from the Cardiff Co. He submitted that the junction line asked for by the promoters would be a great public convenience.

After conferring the Committee decided that it was not expedient to sanction the making of the proposed junction line.

The provisions giving powers for operating the line by electricity were next considered. It was stated that the company desired to work the whole of the line by that means.

Mr. Beasley, the general manager of the company, said that it was intended to work the line by self-contained motor-cars. No overhead wires would be used.

The Committee decided not to order the construction of a bridge over a level crossing on property belonging to Lord Aberdare.

On 18th inst. the hearing was resumed. The Mountain Ash Urban District Council asked for the insertion of a clause for the

substitution of bridges for the proposed level crossings at Abercynon and Penrhiwceiber.

Counsel for the Taff Vale Railway Co. said that an enlargement of the present subway at Abercynon would meet the case. His company were prepared to contribute one-third of the cost.

A large number of witnesses were called on the question of the crossing at Abercynon, and the Committee decided that they would not refuse the electrical powers sought by the company because of the non-provision of the bridge asked for. The opposition with regard to the Penrhiwceiber crossing was, therefore, not proceeded with.

The remaining clauses were dealt with on the 19th inst. The application of the Mountain Ash Urban District Council for words to be inserted preventing the company from supplying electricity to any other person was refused. A clause extending the time for the completion of the railways from Alfvndd to Pontypridd, which were authorised in 1890 and 1896 was also refused. It was stated that the extension of time was asked for because the railway company were about to remodel and reconstruct Pontypridd Station. The Committee, however, granted an extension of time for giving notices, from August 7th next to January 1st, 1904. The remaining clauses having been gone through, the Bill was reported for third reading.

Willesden Urban District Council Bill.

The Select Committee of the House of Lords, presided over by Lord Brougham and Vaux, had before them on 22nd inst. the Bill of the Willesden Urban District Council, which confers powers with respect to electric lighting and other matters. The Council seeks by the Bill for power to take lands in Taylor's Lane, Harlesden, for a generating station, and also powers to supply electrical energy in adjacent districts and for traction purposes. Mr. Baggallay, K.C., and Mr. Greig appeared for the promoters. There were several opponents to the Bill, including the Gas Light and Coke Co., for whom Mr. Balfour Browne, K.C., and Mr. Frere appeared.

Counsel having opened the case for the Bill, Mr. Balfour Browne addressed the Committee in opposition to the electricity portion of the scheme, and said that on behalf of the Gas Light and Coke Co. he had to ask that the same provisions should be inserted in the Bill for the protection of that company as had been done in the case of the Bermondsey and Woolwich municipal electric undertakings. The Willesden District Council were seeking powers to erect a large generating station from which to supply adjoining local authorities, who were empowered to supply energy, and they further wished to supply any local authority, company or person owning or working any tramway, railway or light railway partly within and partly without their district. There was a considerable difference of opinion as to how far local authorities should be allowed to indulge in municipal trading, and he believed that the feeling of Parliament was that this sort of trading had already been allowed to go too far. If the Committee granted the request of the Willesden District Council, he asked that the Gas Light and Coke Co. should be given protection against any probable loss which might ensue to them from the electric undertaking of Willesden. He would remind their Lordships that the Gas Co. paid over £2,000 a year in rates, and it would be monstrous, if there should be a loss on the undertaking, that it should be borne by the general body of ratepayers, among whom was the Gas Co. If municipalities were to go in for trading, they should do it on fair terms, and he would ask the Committee to agree to four propositions to secure that result. He would ask the Committee to say, first, that the Willesden Urban District Council should not be allowed to supply energy to local authorities outside its own area; second, that it should also be prevented from supplying electrical energy to tramways outside its own district; third, that if it were allowed to supply electrical fittings at all, it should be put under an obligation not to supply them free; and fourth, that a clause should be put in the Bill similar to that of the South Metropolitan Gas Co.'s clause, providing that the Council should, once a year, after the first year's working, cause to be laid before it a statement and balance-sheet giving the accounts of the electrical undertaking, and that it should thereupon fix annually the charges to be made for the supply of energy in the ensuing year at such a rate that the revenue for the year should balance the expenditure. He explained that the last provision was necessary in order to guarantee that the expenditure should be met out of the revenue each year, and thus avoid any loss coming on the rates.

The Chairman said the Committee had decided that the Council should be restricted to the supplying of energy within its own area. They were of opinion that the last clause asked for by Mr. Browne with reference to an annual balance-sheet and the fixing of prices should be inserted in the Bill. With regard to the question of the supply of electrical fittings, they were of opinion that the clause should remain in the Bill as drafted by the Council.

Pontypridd Tramways.—The Bill promoted by the Pontypridd Urban District Council for the purpose of constructing a tramway came before Lord Camperdown's Select Committee of the House of Lords last week. Mr. Ram, K.C., who represented the promoters, said that the Council sought powers to construct a tramway and to carry out certain widenings and build a viaduct in connection therewith. They desired also to enter into agreements with the owners of other tramways. Under the Public Health Act the Council had borrowing powers to the extent of £264,000. The proposed tramway would connect existing tramways from Cilfynydd and Treforest up the Rhondda Valley. The Council proposed to have powers to run over the Rhondda Valley tramway. There had been difficulties in the way of constructing the proposed connecting piece of line owing to gradients, and the Council had been refused permission several times. It was now desired to leave the road at Mill Street and to go under a bridge of the Taff Vale Railway, and for this purpose a new road would have to be made. Mr. William Lewis, Chairman of the Pontypridd U.D. Council, was then examined. He said that Pontypridd was a market town for a very large area—the whole of the Rhondda Valley. There were a number of collieries in the district. By Mr. Page: It was true that in a certain part of Mill Street there would be only 2 ft. between the tramcar and the pavement. The Chairman asked if he might have a sketch showing how it was proposed to run double lines past that spot. Sir Douglas Fox gave engineering evidence, and said that he had come to the conclusion that the proposed way of dealing with Mill Street was the best way. The upper part of the street would be greatly improved. The Bill was opposed by the Taff Vale Railway Co., represented by Mr. Balfour Browne, K.C.; the South Wales Electrical Power Distribution Co., by Mr. Balfour Browne; and by a number of frontagers for whom Mr. Page, K.C., and Mr. H. O. C. Beasley appeared. Mr. Page, K.C., addressed the Committee on behalf of his clients, the frontagers. He submitted that considerable damage would be done to them by the proposed tramways. His clients were tradesmen, and it was necessary for them to have carts and carriages at the doors of their premises. This they would not be able to have if the trams were allowed. He contended that Mill Street should be widened. A number of residents on this part of the route gave evidence supporting the opposition. Witnesses on behalf of the case for the Taff Vale Railway Co. were then heard. Mr. George Thomas Silbering, engineer to the company, submitted a model, and explained that it was feared that damage would be done to the railway bridge of his company over the River Rhondda. Sir James Szlumper, C.E., gave similar evidence as to the bridge. At this juncture Mr. Ram said that the promoters had come to an agreement with the South Wales Electric Power Co., by which, should the Committee pass the Bill as far as the working of the tramway outside the Council's district was concerned, the company should supply the electric power; but only to those tramways. Mr. Beasley, General Manager to the Taff Vale Co., said that the proposed trams would create a competition of a serious character with his line. Mr. Noble addressed the Committee on behalf of the opposing railway company. He wished the promoters to be limited to working powers up to Porth. Mr. Moon, K.C., said that the promoters would be content to be limited to Porth. The Committee, after conferring for some minutes, found the preamble of the Bill proved.

Salford Corporation Bill.—On 14th inst. this Bill came before the Committee of the House of Lords, presided over by Earl Morley, on Unopposed Bills, and the preamble was declared proved. The Bill is to enable the Corporation to construct additional tramways, and to adopt and use portions of tramways outside the city. The estimate in the Bill for the construction of tramways is £18,000. It provides for agreements being made with the Manchester Corporation with regard to running powers over certain tramways, and also provides for running powers over a portion of the Stretford U.D.C. tramways.

Chard Corporation Gas and Electricity.—This Bill, which authorises the Chard Corporation to purchase the local gas works and to supply gas and electricity, came up before Lord Morley's Committee on Unopposed Bills on 14th inst., and was ordered to proceed. Sec. 42 gives power to supply electricity in bulk to outside authorities. The estimates contain a sum of £10,000 for the purchase of land and erection of a generating station.

Woolwich Borough Council Bill.—On 14th inst. Mr. Jeffreys, the Chairman of Ways and Means in the House of Commons, had before him the Bill of the Woolwich Borough Council, which is an unopposed measure, and authorises the Council to supply electrical energy in bulk to the District Council of Foot's Cray. The preamble was proved, and the Bill ordered to go forward.

Macclesfield and District Tramways Bill.—It is reported from the Select Committee that the promoters do not intend to proceed further with the Bill. It was proposed by the Bill to incorporate the Macclesfield and District Electric Tramways Co., with a capital of £240,000, to construct tramways in and around Macclesfield.

West Cumberland Electric Tramways.—This is a Bill to extend the periods for the commencement of the construction, and for the completion of the tramways, tramroads and other works authorised by the West Cumberland Electric Tramways Act of 1901; to extend the area within which the company may supply electricity, and to confer on the company further additional powers with regard to such supply. It extends for a period of two years, the time limited by the Act of 1901, for the substantial commencement of tramways in Distington, Seaton Villa, Cleator Moor, &c. It extends the area of supply for electricity to include the districts of Arlecdon and Frizington, Cleator Moor, Egremont, Harrington, Maryport, Aspatria, Little Clifton, Broughton and Broughton Moor. The Bill came before the Unopposed Committee of the House of Commons on 14th inst., and the preamble having been passed, it will go forward for third reading. The Deputy Chairman reporting to the House of Commons on the Bill, states that it was proposed to authorise the payment of interest out of capital during the construction of the tramways, tramroads, road widenings, bridge and other works, authorised by the West Cumberland Electric Tramways Act, 1901; but as it was proved to the Committee that this was not a contractor's line, such payment would enable the capital to be much more easily raised, that the locality desired the scheme to be carried out, that it was anticipated that the payment of such interest during construction would facilitate the raising of capital locally, and, moreover, as the Committee found that the payment of such interest was subject to the conditions prescribed by Standing

Order No. 167, they, under the circumstances, allowed the same. With respect to Clause 10, the Committee satisfied themselves that the proposals to extend the periods fixed by the West Cumberland Tramways Act, 1901, to 40 and 50 years respectively, at which the local authorities might exercise their powers of compulsory purchase, were in the public interest, and that the local authorities had not objected thereto.

Dewsbury, Batley and Birstal Tramways Bill.—On 13th and 14th inst. a Select Committee of the House of Lords, presided over by Lord Clifford of Chudleigh, considered the above Bill, which is promoted by the British Electric Traction Co., and has for its object the making of a tramway, in agreement with the Huddersfield Corporation, between Mirfield and Huddersfield, and for transforming the steam tramway which at present connects Dewsbury with Gomersal into an electric tramway. Mr. Moon, K.C., appeared for the promoters, and said that, unless an agreement was arrived at between the promoters and the Huddersfield Corporation, the proposal relating to Huddersfield would be dropped. The only objection to the other portion of the Bill came from the Batley Corporation, whose *locus* he objected to. Mr. J D. Fitzgerald, K.C., represented the Batley Corporation, and said his clients had constructed their own tramways. The steam tramway which it was proposed to electrify would be liable to purchase in 13 years by the local authorities, and the Batley Corporation intended, when the time came, to exercise their powers and take over the portion of the line within their district and work it in connection with their tramway system. The steam tramway was owned by the Dewsbury, Batley and Birstal Co., and to have bought this company it would have been necessary for the British Electric Traction Co. to have obtained the consent of the Board of Trade. To avoid this, the British Electric Traction Co. had bought up nearly the whole of the shares of the company at a little over the market value, and so obtained control. Having done this, they got into communication with the various local authorities for permission to construct tramways or lease them from the local authorities. The Committee decided to hear the Batley Corporation. Evidence was then called in support of the scheme. The chairman suggested that it might be possible for the promoters and the Corporation to come to terms if there was an adjournment. After the adjournment it was stated that an arrangement had been come to, but the nature of the terms did not transpire. The Committee thereupon decided that the Bill should go down as unopposed.

Tramway Orders Confirmation (No 1) Bill.—On May 21st this Bill, which confirms certain provisional orders made by the Board of Trade under the Tramways Act, came before Mr. Campion, Examiner, and Standing Orders were found to have been complied with. The Bill deals with the following orders:—Burton-upon-Trent, Bury, Cardiff, Huddersfield, Leeds, Newcastle-on-Tyne, Portobello and Musselburgh.

Tramways Orders Confirmation (No. 2) Bill.—This Bill, which confirms certain orders granted by the Board of Trade under the Tramways Act, came before Mr. Campion, Examiner, on May 21st, and Standing Orders were found to have been complied with. The orders relate to the following districts:—Barrow-in-Furness, Horsforth, Keighley, Ramsbottom.

Walton-on-Thames Electric Lighting.—The Walton and Weybridge Gas Co. has deposited a petition in the House of Commons in opposition to the confirmation of the Electric Lighting Order to Walton-on-Thames which is contained in the Electric Lighting (No. 5) Bill.

Preston and Horwich Tramways.—The Select Committee of the House of Lords had this Bill before it on May 20th. Counsel for the promoters said that the Bill was to incorporate the Preston and Horwich Tramways Co., and to give that company power to construct tramways of a total length of 23½ miles. The lines would commence at a junction with the authorised tramways of the Preston Corporation, and would connect Preston with Horwich. After passing through Walton-le-Dale, one line would connect with the other which would pass through Lostock Hall. From Bamber Bridge, where the lines would meet, they would proceed through Clayton Green and Whittle-le-Woods to Chorley, where one branch was to diverge to Standish and the other to Adlington and Horwich. At Chorley the line would connect with the Wigan Corporation tramways, the other line connecting at Horwich with the Bolton Corporation trams. When complete the line would connect with the South Lancashire tramway system. The cost of the new lines would be £236,622 Opposition to the Bill came from the South Lancashire and Cheshire Coalowners' Association and the Mining Association of Great Britain, who wished the lines to come under the Light Railways Act, so as to be under an obligation to carry minerals. The Committee refused this application. The Committee found the preamble proved.

Electric Lighting Orders Confirmation Bill (No. 7).—On Monday the Examiner found that Standing Orders had been proved in respect of the above Bill, which confirms Orders to the following districts:—Cambridge, Isle of Sheppey and District, Sandwich, Deal and Walmer, Sittingbourne and Milton, Strood and Dartford (Rural Districts), Tadcaster and District (Extension), Uxbridge and District (Extension), Wimbledon (Extension).

Bradford Corporation Bill.—The Omnibus Bill of the Bradford Corporation had been before a Committee of the House of Lords, presided over by Lord Brougham and Vaux, for several days, and the preamble was proved on 21st. inst. with regard to most of the proposals. The Bill provides for some additional tramways at a cost of £9,397, and makes arrangements for an interchange of traffic with Shipley.

Blackheath and Greenwich District Electric Light.—The preamble of this Bill was found proved on 22nd inst. by the Unopposed Committee of the House of Commons. It confirms an agreement for the transfer of the Lewisham and District Electric Supply Co. to the Blackheath Co.

India-Rubber, Gutta-Percha and Telegraph Works Co.—This Bill, which enables the company to accept and hold shares in other concerns in settlement of work done or goods supplied, came on 19th inst. before the Chairman of Ways and Means in the House of Commons. There was no opposition, and the Bill was ordered to go forward for third reading.

Electric Light Provisional Order (No. 4).—This Bill, which confirms Board of Trade Orders in respect of Borrowstounness, Cambuslang, Irvine, Kilmalcolm and Kirkintilloch, came on May 22nd before the Unopposed Committee in the House of Commons, and was ordered to be reported for third reading.

Dover Corporation.—On May 22nd, the Dover Corporation Bill came before the Chairman of Ways and Means in the House of Commons as an unopposed measure, and the preamble was found proved. It enables the Dover Corporation to purchase the undertaking of the Dover Electricity Supply Co., and to borrow for that purpose and to extend the undertaking, the sum of £155,000.

Gosport, Fareham and Cosham Tramways Bill.—Last week Mr. Campion, the Examiner, had before him an additional provision to the above Bill brought forward by Mr. Kennedy on behalf of the promoters, who are the Portsmouth Street Tramways Co. The object of the Bill is to enable the company to adopt the existing tramways in Gosport, Alverstoke and Fareham for electric traction, and to construct new tramways. In the petition it was stated that after negotiations the Fareham U.D.C. wished the company to schedule other land for a generating station, and the Alverstoke U.D.C. wished some deviation of the proposed tramways and the construction of a further short line. Mr Birchell presented a memorial on behalf of the L. and S. W. Railway Co. against the additional provision, and Mr. Baxter presented two petitions. One from the Rev. A. Keir, and others contended that a tramway 1½ miles long was not a "short tramway." The other was from frontagers and alleged non-notice. Mr. Kennedy admitted that with regard to the third petition, he must accept a finding of "non-compliance," as the alterations were made too late for the proper notices to be given. He objected altogether to the other two memorials. Mr. Campion found "non-compliance" with regard to notices, and refused the other two memorials. The Bill will now have to go before the Standing Orders Committee, who will decide whether it shall proceed.

Tynemouth and District Tramways Bill.—This Bill came before Lord Morley as an unopposed measure on May 21st, and formal evidence having been called, the preamble was declared proved. The Bill authorises the Tynemouth Tramway Co. to construct about 2½ miles of additional tramway at a cost of £35,021.

Electric Lighting (London) Bill.—In the House of Lords on 25th inst. the Electric Lighting (London) Bill passed through Committee. On 26th inst. it was read a third time and passed.

Aston Manor Improvement.—This Bill, amongst other things, makes further provisions with regard to the electric light undertaking of the Council, and takes power to supply electricity outside the district. It was on May 21st before Lord Morley's Committee on Unopposed Bills, and was ordered to go forward.

THE RICHMOND-CAREY AUTOMATIC ELECTRIC LIFT.

The growing demand for power lifts, and particularly for electrically operated ones, has compelled the attention of many designers, but not all of these can claim the measure of success which has attended the efforts of Messrs. Richmond and Carey, who exhibited a model of their automatic electrical lift at the meeting of the Institution of Electrical Engineers held on May 14th last.

The inventors call attention to the fact that the majority of so-called lift accidents are due to causes other than the lift itself, and in many cases to carelessness only.

The following points in the working of this lift are worthy of attention:—

1. If a man at one floor has pressed a button, all other buttons are locked while the lift is in use, and no one else can interfere with the lift; it is a case of first come first served.

2. While loading or unloading the lift, the door where the cage is, must obviously be open, and when this is the case, it is impossible for anyone to start the lift.

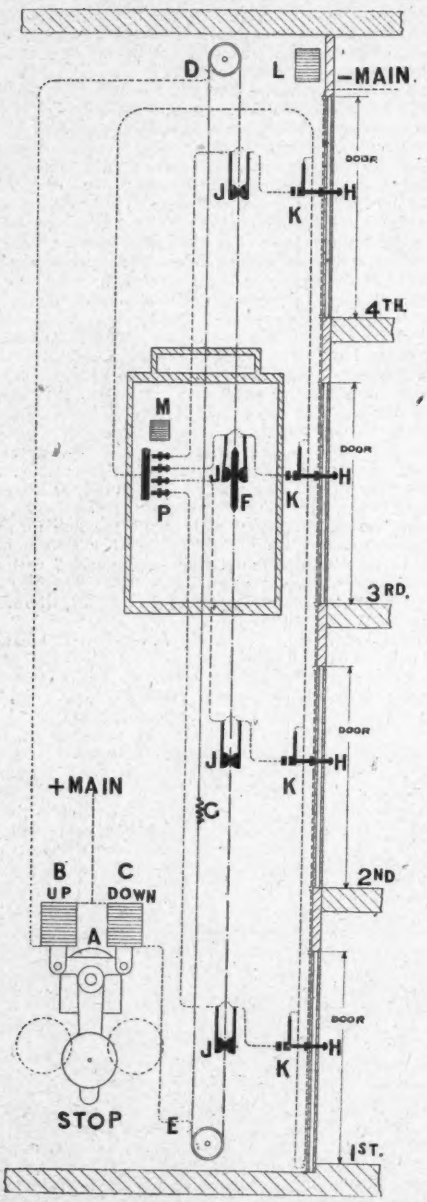
3. If a passenger had stepped into the lift, and before he has had time to press a button, someone else tries to start the lift from another floor, the passenger in the car can stop the lift by pressing a button marked "stop," or a false-hinged floor constructed to depress slightly when a load is in the cage, will throw the buttons on the various floors out of action by breaking the circuit, while leaving the buttons in the car in action.

The diagram overleaf shows the simplicity of the apparatus. The motor, gearing and brake are not shown, as they are of the ordinary type. The push-button control is worked by an independent low-voltage current, preferably of not more than 50 volts. It is this circuit only with which we need deal.

Referring to the diagram:—A is the main switch controlling the movements of the lift. The pendulum always tends to return the switch to its central position, as shown. In this position the lift is at rest.

B and C are two solenoids. When a current passes through B, the switch A is set so as to cause the lift to rise, when through C to descend.

B and C are connected direct to the positive main; the other end is connected to two contacts D and E, which transmit the current to movable wire cords shown in alternate dot-and-dash lines. These cords are two in number, preferably of copper, and they form together an endless rope which passes round two sheaves fixed at top and bottom of the well-hole. They are separated, however, at



Richmond-Carey Patent Electric Lift.

two points, F and G, by insulating material; at F by a piece of insulating material fixed to the cage, and to which the wire cords are fastened, and at G by an insulated spring, which keeps a certain amount of tension on the cords.

H, H, H, H, are a series of push buttons, one for each floor, all of which are connected to the negative main.

J, J, J, J, are contacts which grip the movable cords, one pair being fixed at each floor.

K, K, K, K, are small switches, which, when a button is pressed, connect the negative main to the pair of contacts, J, for that particular floor.

The buttons H, H, H, H, are kept in their normal position by springs, and are provided with collars, which are locked in whatever position they may happen to be when current begins to pass through the main motor circuit, by means of the solenoid L at the top of the well-hole.

This solenoid actuates a small rod (not shown) which passes down the entire length of the well-hole and moves locking levers. The button, which is pressed in, is locked in this position, and the spring cannot return it. The other buttons are locked in their normal position, so that no one can press them in until the circuit is broken.

The action is briefly as follows:—Anyone pressing the button on the second floor causes a current to flow from the positive main through solenoid C, through contact E and the movable cord, through contacts J on second floor, and away to the negative main. The motor circuit is now passing through solenoid M and locking the buttons, P, in the cage and through solenoid, L, at the top of well-hole and locking the buttons H, H, H, H.

With solenoid C in circuit the main switch A is set so that the car descends until the insulating piece, F, on the cage passes between the contacts, J, on the second floor, breaking the current. The pendulum immediately returns switch A to the central position and stops the lift, and the locking solenoids, M and L, release the buttons.

If a button on the fourth floor were pressed, the circuit would be complete through B, and would set the main switch, A, for the lift to ascend.

The action of the pushes in the car is similar. The current is taken to the contacts J of whichever floor it is desired to reach through flexible wires which are in connection with the buttons P in the cage, each of which is marked with the number of the floor to which it is connected.

The doors are self-closing, and are fitted with circuit-breakers, so that if any one door in the series be open, the circuit is interrupted, and the lift cannot be started. Each door is fitted with a spring catch on the inside of the well-hole, and is always locked except when the cage is opposite the floor, when a cam-piece on the car automatically releases it, so providing access to the lift.

If a door be opened at the moment the car is in front of a floor (the door at this moment being, of course, unlocked), the current is interrupted by the circuit-breaker, and the lift comes to rest.

In the unlikely event of two persons on different floors pushing buttons simultaneously, the car will travel to the floor farthest from that at which the cage was at rest, when it will stop, unless the person at the intervening floor should stop the lift previously by opening the door as the car passes.

The lift will shortly be placed on the market by Messrs Joseph Richmond & Co., Ltd., engineers, 30, Kirby Street, Hatton Garden, E.C.

BUSINESS NOTES.

Electrical Wares Exported.

Week ending May 27th, 1902.		Week ending May 26th, 1903.	
Adelaide. Teleg. cable .. Value	£242	Alexandria .. .. Value	£1,190
Alexandria	370	Amsterdam	30
Amsterdam	58	Bahia..	50
Bangkok	140	Bombay	164
Bombay	119	Brussels	17
,, Teleg. mat.	834	Buenos Ayres	195
Brisbane	85	Calcutta	250
Calcutta	896	Cape Town	572
Cape Town	58	Colombo	58
,, Teleg. mat. ..	750	Durban	1,299
Christchurch	10	East London	72
Copenhagen	25	Fremantle	21
Delagoa Bay	47	Gibraltar. Teleg. cable.. ..	8,120
Demerara	35	Gothenburg..	100
Durban	1,618	Halifax	75
East London	669	Hamburg. Teleg. mat.	270
,, Teleg. wire ..	476	Hayti. Teleg. cable	2,146
Fouchou	19	Hong Kong	25
Fremantle	45	Lisbon. Teleph. mat.	106
Gibraltar	121	Lyttleton	50
Gothenburg. Teleph. cable ..	243	Malta. Teleg. cable	9,340
Melbourne	305	Melbourne	88
Monte Video	20	,, Teleg. cable ..	1,350
Ostend	60	Montreal	63
Port Elizabeth	1,020	North Atlantic. Teleg. cable ..	6,000
Singapore	25	Otago	182
Sydney	645	Perim. Teleg. cable	12,650
Wellington	36	Port Elizabeth	4,315
Yokohama	650	Port Said	30
		Rotterdam. Teleg. wire ..	45
		St. Petersburg. Teleg. wire ..	61
		Shanghai	386
		Singapore	11
		Stockholm. Teleg. mat. ..	142
		Suez	175
		,, Teleg. cable	15,280
		Surinam	32
		Sydney	673
		Toronto	54
		Wellington	89
		,, Teleg. mat... ..	322
		Yokohama	22
Total ..	£9,121	Total ..	£72,120

Foreign Goods Transhipped.

East London. Elec. goods Value	£115
Sydney. Elec. lamps	32
Total	£147

Technical Press Index.—We have received Nos. 1 and 2 (April and May) of a new "Index of the Technical Press," which is being published by the Association de la Presse Technique, of 20, Rue de la Chancellerie, Brussels. The principal articles of general interest appearing in the technical journals are indexed, the title being generally given in the language in which the originals were printed, viz., in English, French or German. The details given include, in addition to the title and a brief explanation, the name of the author, the name and date of the publication, and the length of the article referred to. Engineering has been considered to claim first attention, and the literature of electrical engineering is very fully represented. The entries are printed on one side of the paper only, so that they can be cut out, if required, for filing on the card index system.

Italy.—La Società Co-operativa Locanese per l'Illuminazione e Distribuzione di Energia ad Uso Industriale is the name of a company which has just been formed at Locana (Ivrea) to establish a central electricity station in the town.

The Fire Exhibition.—The exhibition at Earls' Court contains a few exhibits of interest to the electrical engineer, but on the whole it cannot be said that electricity is to the fore. Among the principal exhibitors are the following:—

QUEEN'S PALACE.

No. 104.—THE NATIONAL TELEPHONE CO. has a very comprehensive exhibit of alarms and telephonic apparatus, including the "Liverpool" alarm system, the "Glasgow" police alarms, the fire alarm systems as used in Bolton, Leeds and South Shields, together with miscellaneous samples of fire and police alarm apparatus. There is also a public telephone call on the stand connected with the N.T.C. Exchange system.

No. 63.—P. HENSEL & Co. have an interesting exhibit of what they style "The National Fire Alarm." This consists essentially of a thermostatic spring, fixed at one end, and free to move at the other. A rise of temperature causes the spring to deflect upwards. Above the free end, an adjustable contact and pointer are mounted. The pointer may be set to any desired temperature above the normal, and in the event of a fire, or any other cause raising the temperature to the degree indicated, an alarm is given. A complete working system is shown including indicators, gongs, and a timing mechanism which rings up the fire station after a predetermined time. If the watchman can deal with the fire himself, he has sufficient time, therefore, to switch off the fire station circuit, and so save a needless call.

At the time of our visit we were unable to see a proper heat test, but caused an alarm to be given by holding a lighted match under one of the thermostats.

No. 72.—THE MAY-OATWAY FIRE APPLIANCES, LTD., exhibit samples of their thermostats, and also a complete fire station watch room, which is connected electrically with a shed in the Queen's Court. We tested the efficacy of the system by lighting a pan of methylated spirit in the shed, and in 28 seconds the alarm was given by a large gong outside the building.

On returning to the fire station watch room, we found the indicator down, and the signal —— —— — recorded on the Morse receiver. The principle of the system is demonstrated by means of a copper wire attached to a pointer, which is deflected on the wire being heated by means of a spirit lamp. As is pretty generally known, the alarm system depends upon the expansion of a copper wire, which is compensated for ordinary rises in temperature by a steel guard to which the ends of the wires are fixed. The accuracy of this compensation is vouched for by the fact that, although the thermostat in the testing shed was adjusted on a cold day some few weeks ago, it has never varied, and had just the same margin during the sudden change in the weather last Friday, although the shed receives the full force of the sun's rays. Visitors should ask to see the heat test.

No. 80.—The SYNCHRONOME CO. is exhibiting electrically controlled clocks. A self-wound electrical controlling pendulum fixed in the company's enclosure operates a circuit of 30 dials, of which about a dozen are distributed throughout the exhibition buildings. The controlling pendulum is operated by two wheels only, which are actuated by the fall of a weighted lever. The lever is lifted every half minute by an electro-magnet energised by a Leclanché cell. The "dials," which take the place of ordinary clocks, contain only one wheel each, and are all connected in series by a single line of wire.

No. 82.—The SIMPLEX STEEL CONDUIT CO. has a very neatly arranged system of its special pipe or conduit system. This system is too well-known to need description.

Many of the exhibits are not yet completed, or were not open at the time of our visit.

Bankruptcy Proceedings.—At the May sitting of Warrington Bankruptcy Court, Walter Trevitt Sampson, electrical engineer, of Warrington, applied for his discharge from bankruptcy. The Official Receiver (Mr. Dibb) reported that the estate had not realised 10s. in the £, and that the books did not show the true financial position of the business. Mr. A. Browne, applicant's solicitor, stated that his client had been unable to give the whole of his attention to the business in consequence of illness brought on through debtor plunging into the Mersey and saving a lady. Judge Rowlands, K.C., said debtor deserved the sympathy of all, and he granted him his immediate discharge; he also directed that judgment should be satisfied when the creditors had received 3s. in the £.

A meeting of the creditors of the Van Hinden Electrical Co., Ltd., was held at Liverpool on May 20th. The statement of accounts showed unsecured liabilities amounting to £1,743, assets £728, 609 ordinary shares, £609, and a deficiency of £2,466. The Official Receiver said there was no doubt that this was a one-man company, Mr. Van Hinden and his wife holding the whole of the shares with the exception of five taken up by other individuals in order to comply with the Act. Mr. Van Hinden had held a meeting of directors—that was himself and wife—and they passed a resolution to mortgage the stock and give themselves a debenture for £840. There was an action at the present time in the Chancery Court to enforce the security under that debenture. The estate was left in the hands of the Official Receiver, and for the present the question of deciding whether the debenture should be contested was deferred.

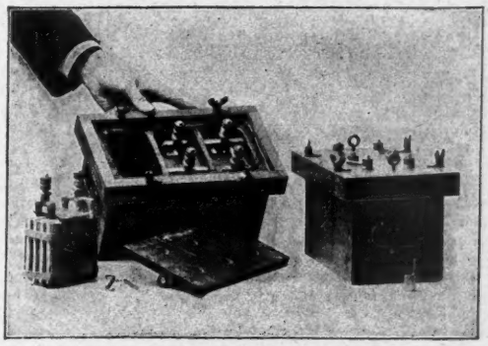
Dissolutions and Liquidations.—Creditors of Rosling and Fynn, Ltd. (in liquidation) must send particulars of debts or claims to the liquidator, Mr. W. M. Gray, District Bank Chambers, Bradford, by June 27th.

The members of the Unbreakable Pulley and Mill Gearing Co. will have an account of the liquidation placed before them on June 23rd.

The Stewart Electrical Syndicate on May 18th passed resolutions for winding-up. Mr. Geo. S. Pitt, of 140, Leadenhall Street, E.C., was appointed voluntary liquidator.

A circular issued by Mr. H. J. Allen, the liquidator of Morgan, Môndey & Co., Ltd., of Rotherham, shows that all that has been realised of the estate has been chiefly absorbed by the debenture holder. There is nothing remaining for the purpose of a dividend.

New Portable Battery.—The block herewith illustrates the latest type of "Umpire" portable battery, which the makers and patentees, Messrs. Sutherland & Marcuson, of 61, Chandos Street, call their accessible type. These batteries are specially designed for export, for use on board ship for wireless telegraphy, &c. Each element is quite independent of the others, and is fitted with two terminals entirely made of non-corroding materials. The elements are thus readily removable, and can be packed securely in their cells so as to avoid breakage, the packing being removed on their arrival at their destination. When they have been placed in cells and the acid filled in, the lid is then put on, the terminals passing through holes drilled in it. The half-buttons are then turned inwards and the fly-nuts are screwed down. On each terminal there is an india-rubber washer, and the lid, when screwed down, bears on these and on the sealing around the cells, effectually closing them. As is the case with all accumulators, provision has to be made for the escape of gas, so they cannot be inverted or laid



THE "UMPIRE" PORTABLE BATTERY.

on their side, but they are practically watertight and thoroughly portable. The connections are made on top with wire, and the arrangement has the advantage that the cells can be connected all in series, all in parallel, or any combination of parallel and series as desired. The elements are of the well-known "Umpire" type, in which the spaces between the plates are entirely occupied by continuous porous separators, and held together by means of acid-resisting elastic bands, preventing short circuits and falling away of the active material. This form of element, owing to its compactness and solidity, lends itself admirably to the form of construction described above. These accessible batteries are made in all sizes and for any desired voltage, the two shown in the illustration having three cells each (six volts), and having a capacity of 30 ampere-hours.

Nernst Lamps.—It is interesting to note that a large number of A type Nernst lamps have been burning in Buckingham Palace for the last 13 months, and they have given perfect satisfaction. The saving in energy effected is stated to be about 50 per cent. The lamps were supplied by the Electrical Co., Ltd., 122—124, Charing Cross Road.

On the Tramp.—A walking competition over a distance of 29¼ miles, was held by the employés of the Reason Mnfg. Co., Brighton, on Saturday, May 23rd. Out of nearly 60 competitors, the office staff furnished the winner, F. T. Halewood, who led throughout, and won easily in 4 hrs. 52 min. 8 sec.—a fine performance.

The Trigger Life-Guard.—Probably the only perfectly satisfactory test that can be applied to a tramcar "life-guard" is for some unwary pedestrian to fall in the track of an advancing car. What would probably have been a fatal accident was turned into nothing more serious than a fright by the recent application of such a test to the Brush Trigger life-guard. A child tripped on the rails immediately in front of a car. Her frock touched the "trigger" and released the guard, which picked her up quite uninjured.

A Street Guide.—A handy little penny book, "Everybody's Street Guide to London," has been brought out by John Dicks, of Effingham House, Arundel Street, W.C. The contents are arranged in three parallel columns:—(1) Giving the name of the street and its postal district; (2) the name of the nearest main thoroughfare; (3) the nearest railway station.

Books Received.—"Telegraphic Vocabularies adapted to Telegraphic Signals," by James Nicholson. London: Whittaker and Co., 2, White Hart Street. Price 5s.

"Elementary Treatise on Electricity and Magnetism," by C. Carey Foster and Alfred W. Porter. London: Longmans, Green and Co., 39, Paternoster Row. Price 10s. 6d. net.

Catalogues and Lists.—Messrs. Cochran & Co., Annan, Ltd., of Annan, have arranged to manufacture flanged plates for all sizes of vertical boilers, tanks, air receivers, &c. Their standard flanged crowns, which are all stamped in one heat by hydraulic machinery, may be had either with edges machined ready for caulking, or unmachined. We have before us a price list of these plates.

We have received from the Brush Electrical Engineering Co., Ltd., of Belvedere Road, S.E., Bulletins Nos. 1 and 2, which form the first of a new series of publications which they are to place before engineers. No. 1 is devoted to an account of the Brush high-speed, double-acting enclosed engines and dynamos for electric lighting, traction and power; all of the details are fully described, and exquisite art pictures of 200 and 300 kw. sets appear. Bulletin No. 2 particularises in the same way and with similar excellent illustrations, the Brush-Parsons steam turbo-generators, to which we devoted a special article in our issue of May 8th.

A show card of electric light and traction castings for pillars, posts, street boxes, cable troughing, &c., has come to hand from Messrs. Rowland Carr & Co., of Lime Street Square, E.C. A list of their Franklin patent ventilating frame and cover accompanied it.

Mr. Arnold Kramer, of Parliament Mansions, Westminster, has placed in our hands a number of illustrated and descriptive price lists of the electrical manufactures of Max Schorch & Co., Ltd., of Rheydt. They deal respectively with direct-current dynamos and motors, switchboard instruments and apparatus, arc lamps and accessories, rheostats for direct-current motors, dynamos for electro-chemical purposes, incandescent lamp fittings and polyphase current motors. The details are tabulated and clearly illustrated. The firm makes a speciality of power installations for factories and central stations of middle and smaller sizes.

Another excellent pamphlet has been brought out by Messrs. Siemens Bros. & Co., Ltd. It describes their most recent search-light projectors. The illustrations include 36 in. projectors for fortresses, with tipping motion electrically controlled; 24 in. sizes for warships and mercantile marine use, and others for launch and other service.

"A Word about Fans" is the title of the third of Messrs. R. J. Nicholson & Co.'s series of electrical booklets. Several styles of electric fans for different purposes are shown, and prices are given of a few sizes.

The Westinghouse Brake Co., Ltd., is circulating a small pamphlet containing a reprint from the *Times* respecting the Westinghouse electro-pneumatic signalling system and its use on American railways.

Messrs. P. Hensel & Co., of 12, Long Lane, E.C., have sent us several lists of their "National" fire alarm and electric thermo-static temperature-controlling apparatus, which they are exhibiting at the International Fire Exhibition now running at Earl's Court. The lists are illustrated and priced.

Mr. James Murchie, of 39, Mains Street, Glasgow, has issued a reduced price sheet of steel balls for bearings.

Messrs. O. Berend & Co., Ltd., have sent us several new lists of portable hand tachometers, high tension switching apparatus, cut-outs, lightning arresters, &c., also a trade price list of dead-beat standard wattmeters for direct, single and polyphase alternating currents, and various types of switchboard and portable instruments.

The Electrical Co., Ltd., has sent us copies of its price list No. 2A of portable motors and drilling machines, and of supplementary list No. 2 of small dynamos, just issued from the press.

We have received a price list of engineers' photographic papers for drawing office use from Mr. A. Messerli, of 165, Queen Victoria Street, E.C. Mr. Messerli, who has been carrying on business in these papers at Zürich for the past 25 years, has now started works in London.

For Sale.—The Cleckheaton Council is offering a 14-h.p. Crossley gas engine and a Holmes dynamo for sale. See our advertisement pages to-day.

On June 11th Messrs. Wheatley Kirk, Price & Co. will sell by auction the surplus plant, &c., at the old works of the Phœnix Dynamo Co., at Bradford. Particulars are given among our advertisements to-day.

Trade Announcements.—Messrs. Hunt & Hess, of Hackney, N.E., have appointed Mr. Harold Elliot, of 30, Bootle Street, Manchester, as sole agent in Lancashire and Cheshire for their litholite and electric insulator goods.

The Metallic Seamless Tube Co., Ltd., of Birmingham, has now opened a depôt at 13, Carliol Street, Newcastle-on-Tyne, under the charge of Mr. J. A. M. Collier, who will also represent the company in the counties of Northumberland and Durham.

Mr. Harold Elliot, for many years in the employ of a leading firm of electrical manufacturers, has opened an office at 30, Bootle Street, Manchester, as manufacturers' agent for the supply of electrical goods of all kinds.

M. Charles Berthiez has been appointed managing director of the Usines Bouhey, machine tool makers, of 43, Avenue Daumesnil, Paris.

In our note *re* the Armorduct Improved Electric Conduit Co.'s various branches last week, we omitted to state that the head office of the company is at 5, St. Nicholas's Buildings, Newcastle-on-Tyne.

The business of Messrs. W. E. Dove & Co., electrical engineers, of Crown Street, Darlington, has been amalgamated with that of Messrs. F. W. Murray, Ltd., of Printing House Square, Bondgate, Darlington, where the combined businesses will be carried on under the management of Mr. W. E. B. Dove.

The Simplex Steel Conduit Co., Ltd., has found it necessary to open premises of its own in Glasgow. The company now has a branch office and stores at 165A, West George Street, Glasgow, under the management of Mr. D G. Brooks. A large stock of all grades of conduits and fittings is kept.

Messrs Foxcroft & Duncan have appointed Mr. Harold Elliot, of 30, Bootle Street, Manchester, as their agent for Lancashire, Cheshire, West Riding of Yorkshire, and North Wales.

Messrs. Parmiter, Hope & Co., of 17, Dickinson Street, Manchester, have removed their offices to Hulme Electrical Works, Manchester, to which address all communications should be sent.

Exports of Electrical Machinery.—The value of the exports of British electrical machinery during April last amounted to only £34,314, as contrasted with the £37,574 in March last. The total for the four months ending with April is returned at £147,569.

The French T.H. Co.—The Report of the Compagnie d'Electricité Thomson-Houston de la Mediterranée reports a profit of £31,494 for the last financial year, as compared with £24,910 in 1901-2.

The Transvaal.—The imports of electric cable, wire and fittings into the Transvaal during the two months ending with February last attained a value of only £3,000, as compared with £4,000 in the first two months of 1902.

ELECTRIC LIGHT AND POWER NOTES.

Abingdon.—Mr. Wall Wilkinson has submitted to the T.C. a report on the question of electric light for the town. He estimates that the scheme would become remunerative after two years' working, and he advises the Council to have the prov. order in its own hands. The Council has requested the borough accountant to report on the financial aspect of the question.

Bangor.—At Bangor County Court on Monday the Mayor and Corporation of Bangor sued Richard M. Griffiths and Richard Davies for money due under a bond of guarantee in connection with the electric light undertaking. For the T.C. it was stated that the electric light would not have been introduced into the town but for the fact that several persons agreed to take and pay for a certain quantity of energy per annum for five years. Mr. Griffiths agreed to take 400 units a year, but he had not had the installation put in. Mr. Davies had not consumed the amount guaranteed. For the defence it was stated that Mr. Griffiths had left the town, and could not, therefore, take a supply; while on behalf of Mr. Davies it was urged that he failed to consume the requisite amount owing to the supply being provided too late. The Judge reserved his decision in the case against Mr. Griffiths, and in the other case found for the defendant with costs.

Barrow.—It was announced at the meeting of the T.C. on Monday, that the electricity department had incurred a deficit for the year of £400.

Bedford.—The T.C. has decided to light High Street and St. Mary's Street with 14 arc lamps, in place of the present 32 incandescents, at an estimated cost of £500. This will effect an annual saving in cost of £150. In other parts of the town, 62 gas lamps are to be replaced by electric incandescents.

Benwell.—The U.D.C. on Monday decided to advertise for tenders for the supply of electricity in the district.

Bombay.—The Brush Electrical Engineering Co., Ltd., has secured a site for the erection of a central generating station for the supply of electric light and power in Bombay, on the northern side of Prince's Dock. The company has approved of the plans of the building, only the formal sanction of the Port Trust and municipal authority being now necessary before the work is taken in hand. It is intended to lay down a high-pressure alternating plant with transformers at suitable centres. The distribution will be by direct current on the three-wire system, the pressure being 460 volts between the outer wires. Mr. Steinitz, the chief engineer to the company, is of opinion that a supply of electrical energy for lighting and power (fans) will be available in the Fort within 12 months. The company proposes to charge for energy on the Brighton or maximum demand system with a rate of 8 annas per unit for the first hour's use of the maximum demanded, and 3 annas per unit for all subsequent supply for lighting, and and 1½ annas per unit for power. At these rates the cost to an ordinary consumer will work out at less than the cost of gas or oil, and considerably less than the rates they are permitted to charge under their agreement with the Corporation.

Bradford (Yorks.).—The T.C. has decided to have the electric light installed in the Cartright Memorial Hall.

The Board of Guardians has resolved to have the Sanatorium for Consumptives, at Eastby, lit by electricity.

Bury (Lancs.).—The Corporation Electricity Committee reports that the undertaking shows a gross profit of £3,078, and a net profit of £21. Last year there was a loss of £159. There were sold during the year 424,993 units, being an increase of 101,656 over the previous year.

Application is to be made to the L.G.B. for a loan of £45,000 for extensions of works and plant.

Caerphilly.—The B. of T. having declined to give the U.D.C. any reasons for refusing to sanction an electric lighting scheme for the Council's area, the Council has decided to take no further action in the matter.

Cardiff.—The annual report on the municipal electricity undertaking shows that the net profits amount to over £3,500.

Chepstow.—The U.D.C. has received notice from the Chepstow Electric Light and Power Co. that under their prov. order they are about to start an electric light works at Chepstow, and propose a continuous current of 240 volts.

Dover.—The Ordnance Department has decided to instal the electric light in the stores and workshops, which are used largely for explosives.

East Ham.—The Electric Light Committee of the U.D.C. has been requested to consider the revision of the charges for electricity by abolishing the maximum and minimum scale and substituting one of 4d. per unit all round, with a scale of discounts for large users.

Edinburgh.—The Electric Lighting Committee of the Town Council has recommended that the charge for private electric lighting be 3¾d. per unit, the same as before, but that the charge for motor power be reduced from 1½d. to 1¼d. per unit.

Elland.—The U.D.C. has fixed the charges for electricity for lighting at 4d. per unit, and for power at 2d.

Falkirk.—An electro-pneumatic sculptor has been introduced to the works of W. Roberts & Son, sculptors, West Bridge Street, and has taken the place of hand labour. An electrically-driven air compressor feeds into a holder at a pressure of 60 lbs. per sq. in. A main feeding pipe and flexible distributors are carried through the yard, and the stones are operated upon by a pneumatic tool held by the workman. The pneumatic apparatus, an American invention, was fitted by Messrs. Jennings, engineers, Aberdeen, and the electrical installation by Messrs. Thomas Laurie & Co., electrical engineers, Falkirk.

Fareham.—The Hants C.C. has applied to the L.G.B. for a loan of £2,500 for additional electric light and power plant at the Fareham Asylum.

Felixstowe.—At a special meeting of the Felixstowe and Walton U.D.C., a motion to take over the business of the Suffolk Electricity Co., and lease it to that company for a period of 25 years, was adopted. The Council is to purchase the whole of the property scheduled for £8,000; £5,000 to be paid within three months of the date of sanction being given by the L.G.B., and the balance of £3,000 to be paid when the net revenue is sufficient to pay 6 per cent. on the first instalment.

France.—A 1,200-H.P. tandem gas engine on the Delamare-Debouteville system is being built by Messrs. Schneider and Co., of Le Creusot, for the ironworks of Messrs. De Wendel & Co., at De Joeuf. The engine is intended to utilise the waste gases of the blast furnaces, and will be used for electric lighting purposes.

Greenock.—As the condensing plant laid down last year, at a cost of £3,472, at the electricity station, has not given satisfaction, the Town Council has resolved to erect a small pumping station at West Harbour in connection with the utilisation of the plant.

Hythe.—The T.C. has decided to request the Folkestone Electric Lighting Co. to at once carry out the agreement for public lighting.

Liverpool.—A resolution has been adopted that the city electrical engineer be instructed to submit a report on the cost of installing, and the annual cost of lighting, the whole of the tramway routes in the city, and the additional cost of lighting other main thoroughfares; and that the resident engineer report on the additions required to the generating plant and cables.

London.—In answer to a question addressed to the President of the Board of Trade relative to its refusal to sanction an extension of the London Electric Supply Co.'s area in the borough of Camberwell, Mr. Gerald Balfour replied as follows:—"It appeared from the evidence that the London Electric Supply Corporation, who obtained Parliamentary powers in the northern part of the borough of Camberwell in 1890, executed no works there until 1898, and at the date of the inquiry had only 64 consumers. Having regard to this and to other circumstances, and also to the fact that the company had made no survey of the proposed area, and no estimates of cost or revenue, it seemed to the Board that the Order ought not to be sanctioned, and, if sanctioned, that there was no probability of its receiving the assent of Parliament. I did not, therefore, think it desirable to put the parties to the expense of fighting the case before a Parliamentary Committee. It has no doubt been the practice to grant competitive powers in the metropolis, but only in the more urban and populous parts. In reply to the second part of the question, the Board of Trade has refused to grant competitive Orders in Clerkenwell, St. Luke's, Hackney, Newington and Wandsworth. I am not prepared to reconsider the decision."

According to a return prepared for the London County Council, the average cost of electricity for private lighting supplied by the local authorities of London is 3·87d. per unit, while for the companies it is 4·58d. Stepney Borough Council obtains 2·73d., and Shoreditch, Poplar, Hammersmith and St. Pancras less than 4d.; while Hampstead receives 4·33d. and Islington 5·16d. Turning to the companies, Chelsea receives just over 5d., Woolwich 5·11d., Brompton and Kensington, 5·54d., Notting Hill 5·71d., and the Southern District of the County of London 5·77d.

On Monday morning last the City of London Electric Lighting Co.'s cables in Cheapside fused, and one of the workmen named Richard Rosewell, who was down in a manhole, was badly burned by the flames. At the same time the lid of a distributing box in Watling street, 150 yards away, was blown out. The services of the fire brigade were necessary before the flames were subdued. Earlier in the morning, at five o'clock, several brigades were summoned to Monument street, where flames were coming out of one of the same company's distributing boxes.

Westminster.—The E.L. Committee of the City Council has considered a plan submitted by the Charing Cross and Strand Electric Supply Corporation for the continuation of electric lighting in the Strand, and showing the proposed arrangement of the arc lamps to be erected between Exeter Street and Temple Bar. The City engineer reported that the lamps are arranged in alternate circuits, to provide against complete failure; that the plan would have been more satisfactory were the lamps on each circuit on both sides of the road, but having regard to the extent to which this system would necessitate the breaking up of the road, and to all the circumstances of the case, he recommended the approval of the plan. This was agreed to. Letters were received from the Board of Trade forwarding for the Council's observations, descriptions of additional systems proposed to be adopted by the Westminster Electric Supply Corporation, Ltd., and the St. James's and Pall Mall Electric Light Co., for the supply of energy under their orders. The City engineer reported that there was nothing objectionable in the proposals, and the Committee resolved to recommend accordingly.

Kensington.—At Tuesday's B.C. meeting the Finance Committee reported that the liability of the Council had been carefully considered in respect to accounts sent in by the Kensington and Knightsbridge Electric Lighting Co., Ltd., for lowering and altering mains in connection with the Brompton Road improvement. The Committee recommended the accounts be passed. This was agreed to.

Manchester.—On the morning of Sunday last there was a serious explosion and fire on the premises of Messrs. T. T. Shann & Co., 83, Fountain Street, Manchester, caused, it is believed, by fusing of electric wires. Two police officers were passing the place at three o'clock when they perceived a strong smell, which led them to examine the basement. They concluded that something was wrong with the electrical installation, and information was at once sent to the Corporation electrical works in Dickinson Street. Before anything could be done, however, a loud explosion took place, which shattered windows, railings and woodwork of the premises. Fire immediately broke out in the adjacent basement of Messrs. Midwood's premises, and the city fire brigade were occupied an hour in putting it out.

Morecambe.—The E.L. Committee of the Corporation recommended the Council to adopt a scheme of giving lamps instead of 2½ per cent. discount to consumers, or charging meter rents. It was estimated that 2,640 lamps would be required at a cost of £152, and that the meters brought in £70. After discussion the proposal was dropped in favour of cash discounts.

Pangbourne.—The Whitchurch and Pangbourne Electric Supply Co., Ltd., has informed the Parish Council that they will shortly be in a position to lay their mains in the parish, and offering to light the village on advantageous terms. The matter is being considered by a Committee.

Portsmouth.—The new Naval Barracks, in which accommodation is provided for about 3,500 men, and which are to be partially occupied this summer, have an installation of electric light, the contract having been placed with Messrs. Bergtheil and Young, Camomile Street, London. Energy is to be supplied from the Portsmouth Corporation electric light station, from which a high tension cable has been laid to a special transformer chamber in the barrack grounds. Externally the lighting will be by 20 arc lamps, placed on the buildings where possible, standards being erected only where absolutely necessary. Internally the lighting is to be by some 3,000 16-C.P. incandescent lamps.

Slough.—A curious problem has arisen in connection with the Slough and Datchet electric lighting supply. At the last meeting of the Slough Urban District Council, an agreement with the Slough and Datchet Electric Supply Co. was presented for sealing, and it was explained that the deed of transfer of the order had been sealed, and that by that deed the Council might, after 24 years or one year's notice, require the company to sell the Slough portion of the undertaking on payment of a sum, which in default of an agreement, might be determined by arbitration; but in order to avoid the necessity for arbitration, except for ascertaining the value, this agreement was proposed, providing that in the event of the Council exercising the option to purchase, the valuation of the company's undertaking "shall be based on its value as a going concern, and such value shall include allowance for goodwill and compensation for compulsory purchase." The point was at once raised that the company had got the right already to lay their mains without payment, and that the Electric Lighting Clauses Act did not contemplate any payment for goodwill, and the question was opened whether the Council should contract themselves out of the Act by sealing this agreement. It was also mentioned that, although Aylesbury had recently disposed of its lighting order for a sum of over four figures, this Council had been advised that the Board of Trade would not sanction a profit on the transfer or sale of an order. That being so, and the Slough Council having (like the Windsor Corporation) transferred their

order without any profit, it was argued that they ought not to make any agreement involving any payment for goodwill, or compensation for compulsory purchase. In the end the consideration of the proposed agreement was deferred, in order that the chairman might make inquiries of the Board of Trade as to the power of the Council to purchase on the basis mentioned in the draft agreement—viz., at a valuation as a going concern, such valuation to include allowance for goodwill, and compensation for compulsory purchase.

Stafford.—A gross profit of £1,489, £826 more than in the previous year, has been made by the municipal electricity undertaking. After allowing for repayment of loans, £434 for depreciation, and £200 to meet renewals to the battery, there is a debit balance of £986.

Wednesbury.—The T.C. has applied to the Local Government Board for sanction to a loan of £11,000 for a scheme of electric lighting in the town, and an inquiry will shortly be held into the application.

ELECTRIC TRACTION NOTES.

Barrow.—At the meeting of the T.C. on Monday, it was reported that the construction of the electric tramways would be commenced forthwith. The track would cost £27,311, and the overhead equipment £5,000.

Brighton.—A correspondent says that at the suggestion of the British Westinghouse Electric and Manufacturing Co., Ltd., the T.C. has accepted £1,000 as damages caused by delay in the completion of their contract for tramcars.

Colne.—On Tuesday last week, the Mayor (Alderman Varley) in presence of a large company, turned the first sod in connection with the Colne and Trawden Light Railway. Mr. Greenwood, of the firm of Greenwood & Batley, Ltd., of Leeds, presented the Mayor with a handsome spade with which to give the undertaking an official start, and stated that owing to certain further powers having to be obtained, the promoters of the company had not been able to proceed with the work before them. They hoped to have cars running within four months. The Mayor wished the undertaking every success, and hoped it would be a boon to the inhabitants and to the Corporation which will supply the energy to run the cars. Owing to the electricity works not being sufficiently employed, a heavy loss has occurred in the working of the department during the past year.

The Coming of the Electric Voiture!—Last week in our note on "Electric Carriages," page 872, we recorded a remarkable run made to Reading and back by a little carriage built for two persons. This has been completely eclipsed by a later performance on the 12th inst. The number of accumulators in the vehicle referred to was increased from 18 to 24 cells, coupled up in two parallels, having a total voltage of 24 at the terminals. The run to Reading was made in 3 hours 15 minutes, arriving there with the voltmeter indicating 22 volts. A further run of 10 miles was made in order to discharge the cells, but they were still far from being exhausted. They were recharged in one hour, and the return journey to London was made in 2 hours 50 minutes, at an average speed of 14 miles an hour. The following day the cells were charged with 5 units (half charge), and a run about town of 39 miles was accomplished during the next two days. This is a most important point, as the cells had only half a charge, and the discharge extended over two days with a night of inactivity in between.

Dublin.—The Tramway Co. is experimenting with the Thermit rail-welding process in connection with the extensions to Drumcondra.

Folkstone.—The T.C. has appointed Mr. Lacey to advise them as to the system of electric tramways to be adopted for the town.

Huddersfield.—The borough treasurer has reported to the Committee the receipt of a quotation for the renewal of the insurance (third party risks) for the ensuing 12 months with the Compensation and Guarantee Fund, Ltd., and the Committee decided that the insurance be effected on the terms mentioned.

The total receipts from the tramways for the month of April amounted to £5,203 18s. 2d., or 9·23d. per mile, an increase of £1,680 11s. 2d. upon the corresponding month of the previous year.

Italy.—It is reported that the Mediterranean Railway authorities have decided to convert the railway between Turin and Torre Pelice into an electric line.

Lancaster—Morecambe.—Another hitch has occurred in the negotiations between the directors of the Lancaster and District Tramways Co. and the Tramways Committee of the Lancaster Corporation in regard to the terms of purchase of the horse traction lines from Lancaster to Morecambe, with a view to electrification. Twice the parties have got to the stage of naming the figure and then the negotiations have suddenly stopped. The four representatives (three directors and solicitor) of the company are all members of the Town Council. The company's license has over six years to run, and Mr. Waller, of London, the expert valuer employed by the Corporation, advised the Town Council to offer £27,000. Upon the question of allowing or not allowing six years' depreciation at the rate of £500 per annum, a dispute arose and the sum of £3,000 blocks progress.

Light Railways.—The Board of Trade report up to December 31st, 1902, respecting its own and the Light Railway Commissioners' proceedings, shows that on December 31st, 1901, 20 orders were before the Board of Trade for confirmation; 17 of these were confirmed in the course of the year 1902, and three are still held over. During the year 1902, 31 fresh orders were submitted to the Board by the Light Railway Commissioners for confirmation. Eighteen of the orders submitted during the year 1902, in addition to the 17 above referred to, making 35 orders in all, were confirmed by the Board of Trade in the course of the year. No orders were rejected during the year. The remaining orders, 13 in number, were still under consideration on December 31st last, but six of them have since been confirmed. The Light Railway Commissioners have received 420 applications for orders to authorise light railways (which include applications for amending orders) since the beginning of the 1896 Act. In respect of 212 applications, orders have been submitted to the Board of Trade for confirmation; 30 other applications, in respect of which orders are under settlement, have been approved by the Commissioners, and 156 applications have been rejected or withdrawn. The decisions with respect to two applications have been deferred, and 20 new applications made in November last remain to be considered.

Manchester and Salford.—The agreement between Manchester and Salford for the running of cars over the lines in their respective districts, or certain sections of them, is expected to come into operation this week. The necessary connections and equipments are now practically complete. A complete service of cars is being organised to suit the changed conditions. There will be provision for through traffic between Whitefield, Prestwich and Higher Broughton on the one hand, and Weaste, Eccles, and Peel Green on the other; and similarly to Pendleton, Eccles, and Peel Green, *vid* Eccles Old Road. From Great Cheetham Street (Broughton), in addition to the above services, passengers will be able to travel direct to Trafford Bridge, close to the Ship Canal Docks, and similiarly to the same destination from the Lower Broughton district.

The Manchester—Liverpool Mono-Rail.—Under the title of the "Mono-Rail Construction Co., Ltd.," there has just been registered at Somerset House a company whose principal object will be to undertake the issue of the capital for the electric high-speed mono-rail between Manchester and Liverpool authorised by Parliament. The engineers for the line are Mr. F. B. Behr and Mr. R. Elliott-Cooper. The *Times* says that the entire capital of £60,000 has been privately subscribed.

Newcastle-on-Tyne.—On the 22nd inst. some suggestions were laid before the Tramways Committee as to various extensions. There were six routes suggested, most of which were to form more or less complete circular routes in conjunction with lines already existing. The Committee decided to have details and plans of the proposed routes printed, and circulated amongst the Council; it is proposed to apply for powers in Parliament for the construction of the routes mentioned.

Oldham.—In view of unofficial statements circulated recently as to the loss on the working of the Corporation electric tramways during the past municipal year, Alderman Chadwick (chairman), at the last meeting of the Tramways Committee, announced that the loss was £7,714 13s. 8d. Included in this sum was upwards of £3,000, charged to the tramways account, but due for interest and redemption on the unredeemed capital of the old tramway system, the lines for which were taken up and new rails laid. £375 per week was allowed for interest and redemption on the capital account. The receipts for the fortnight ending May 19th were £2,272 11s. 3d.

Sunderland.—At the Sunderland County Court, before Judge O'Connor and a jury, on the 22nd inst., the Sunderland Corporation was sued by a Mr. and Mrs. Watson for £50 for injuries received by the latter on January 10th, when she was subjected to an electric shock when alighting from a car. It appeared that on January 10th, Mrs. Watson and her daughter were riding in a tramcar to proceed to Hylton Road, when another car came up from a different direction, and while the conductor was putting the trolley on to the return wire the pole caught in one of the forks at the junctions. As a result two electrically-charged wires came down, and there were brilliant flashes, which made some of the passengers nervous, and Mrs. Watson got out. As she was getting out of the car she took hold of the rod on the car and received a shock. Her health has since suffered so as to interfere with her means of livelihood. Mrs. Watson, in evidence, denied that she was warned to keep her seat.—For the defence, the town clerk submitted there was no case to go to the jury. They had been charged with negligence, but nothing of the kind had been proved. The fact of the wire falling was no proof of negligence in itself.—His Honour thought there was a *primâ facie* case of negligence.—The town clerk, addressing the jury, said the wires were regularly tested at intervals, and on that morning they were gone over. The wire had been properly secured and maintained. He contended that the women had been suffering, not from an electric shock, but from a nervous shock owing to what happened, and for that shock the Corporation was not responsible.—Evidence was given by members of the staff of the tramways to prove that there was no negligence. The rod the plaintiff caught hold of was not insulated, and, therefore, if current were passing through the fittings of the car, owing to the breakage of a wire, the current would not pass through the women.—After an absence of ten minutes the jury returned a verdict for the plaintiff for £25. Judgment was stayed pending an an appeal.

(*Continued on page* 927.)

ELECTRIC LIGHTING OF ALDERSHOT CAMP.

The town of Aldershot possesses more than a passing interest to the average Britisher, in that it is always associated with the headquarters of our Army; in fact, the civilian town sinks into comparative insignificance beside the military portion. The Southern Camp, or Stanhope Lines, as the latter is called, lies immediately north of Aldershot town, and is separated by some half-mile of open parade ground from the Northern Camp, or Marlborough Lines, which adjoin the town of Farnborough on the south.

These camps provide accommodation for 16,000 men. The scheme for providing electric light to the camps in place of the oil lamps previously in use has been in progress for four years, and in itself forms a somewhat unique example of this class of work, in that the requirements and practically the exact outline of the load to be dealt with were settled, in the first instance, and a generating station of suitable capacity laid down complete. An interesting feature is that the load comes on and goes off with the bugle, at times which are, of course, well known, and the proportion of all-night load is very small.

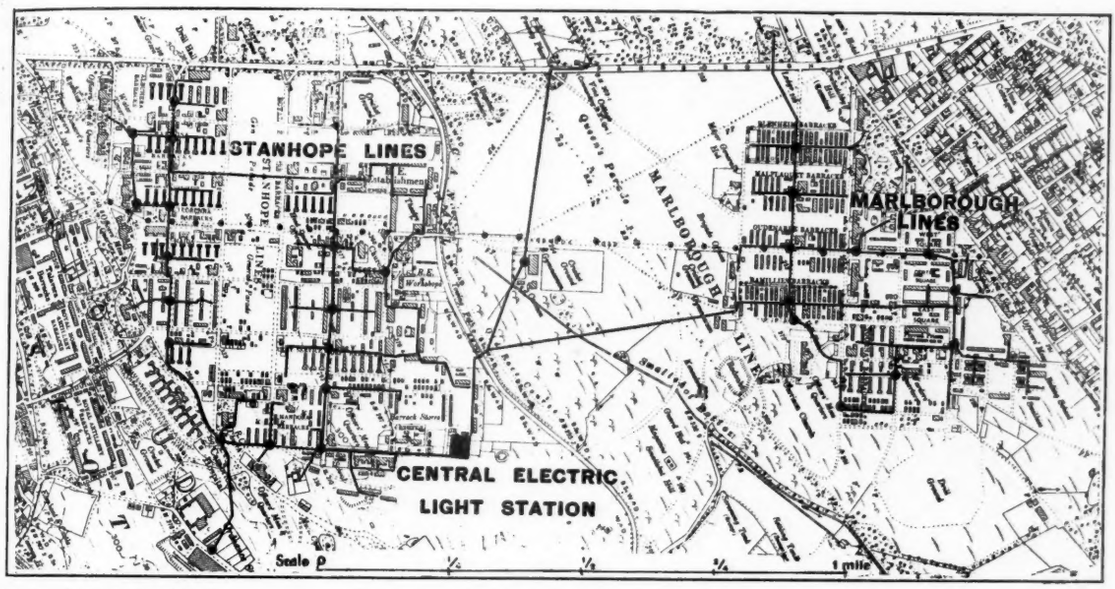
The Engineers have not only had the designing of the generating station and distributing network, but also the whole of the Barrack and building lighting, and certain street lighting, and their jurisdiction extends over the whole of the electrical equipment of the camp.

A better idea of the scope of the undertaking will be gathered from the accompanying plan, in which the generating station will be seen at one corner of the Stanhope Lines, and the main feeders and branch distributors extending through the two camps are clearly shown.

The distribution pillars (above ground) are indicated thus ●, and the arc lamps in the Queen's Avenue, which, running from Aldershot to Farnborough, bisects the camps, are indicated thus •.

The generating station, built in red brick, contains engine and boiler houses, each 65 ft. long, 46 ft. wide, and 26 ft. high from floor to eaves. A battery room, pump room, men's rooms, and a prodigal number of offices are also provided.

In the boiler house there are installed six Babcock and Wilcox boilers in pairs, each capable of evaporating 5,000 lbs. of water per hour, from and at 212° F. They are hand-fired and provided with spring and deadweight safety valves, duplicate feed valves on the front, and a scum valve behind the main steam drum. Five coal bunkers are arranged facing the



Reproduced from the Ord. Survey Map, with the sanction of the Controller of H.M. Stationery Office.

Feeder Pillars shown thus ●, Arc Lamps shown thus •.

PLAN SHOWING DISTRIBUTION NETWORK; ALDERSHOT CAMP.

VIEW SHOWING THE GENERATING STATION AND STANHOPE LINES ALDERSHOT CAMP.

boilers; each bunker normally holds 10 tons of coal, but by stacking, as much as 100 tons, can be stored, and as the Government railway siding is shortly to be extended to the works, greater facilities in the matter of fuel supply will be secured. Welsh coal supplied to H.M. Government under contract is at present used for the boilers.

A miniature track is provided along the front of the boilers —passing over a weighbridge—which facilitates the weighing and handling of coal or ashes.

Two sets of three-throw feed pumps, by Hayward Tyler, driven through double reduction gear by 8 H.P. Siemens series motors, are installed in the pump house. The speed of the motors is varied by series resistances, and each pump is capable of taking the full evaporative load.

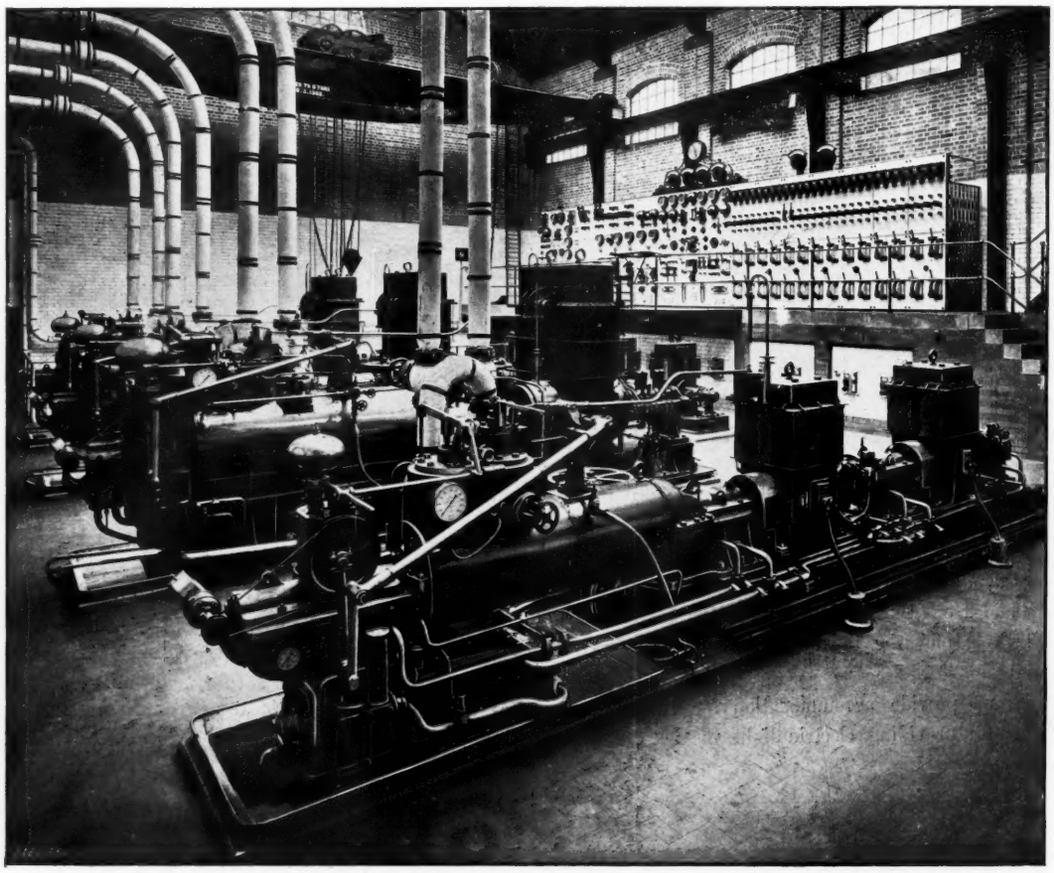
The pumps draw from a feed tank overhead, having a capacity of 17,000 gallons, and deliver each through a Kennedy meter into a duplicate feed range of 3 in. steel pipes. On the delivery side, a bye-pass loaded to 10 lbs. above maximum boiler pressure is provided, the overflow returning to the tank above. The pumps are also arranged to draw from the cooling pond, situated some little distance from the building, if desired in case of emergency.

The feed tank also receives the discharge from the hot well, the common return from the steam traps and the supplementary feed through a ball valve, from the camp supply; Geipel & Lange steam traps are fitted to each of the steam mains and to the return from a steam separator on each turbine.

The steam range, including the bends, is of 6 in. steel pipe with branches riveted on, and is arranged in duplicate at the back of the boilers, a small relief valve being fitted, arranged to blow off at 10 lbs. under boiler blow off pressure; the whole of the pipework was made by Messrs. Babcock & Wilcox. Hopkinson parallel flow stop valves and non-return valves are arranged on each boiler branch; this firm's make of valves being used throughout. A gangway is provided over the top of the boilers, from which the stop valves are readily accessible.

A main flue behind the boilers and an independent reserve flue underneath it, are provided. Two Green economisers of 192 tubes each are inserted in the main flue, which may be used singly, in parallel or in series, the scrapers being operated by 1-H.P. Lundell motors. The chimney, 150 ft. high and 7 ft. 6 in. internal diameter at the top, is situated at the end of the economiser house.

Blow-off pits are provided outside the boiler house; and in each pit a cradle is provided which intercepts any solid matter coming from the boiler, and enables an examination of the contents to be made. The engine house is situated at the side of the boiler house, and contains four Parsons turbo-generators, three being of 250 KW. and one of 100 KW. capacity. The larger sets run at 2,200 revolutions per minute, the generators being bi-polar over-type shunt-wound machines, giving 550 amperes at 450 volts; the smaller set consists of a turbine and two over-type dynamos in tandem, running at 4,000 revolutions per minute, and giving 220 amperes at 450 volts. This set may be used as a steam balancer if required, and by suitable clutches the machines and turbine may be disconnected from each other, enabling the set to be used as a generator of half the total capacity, or as an independent balancer, without the turbine. All the turbines are fitted with governors electrically controlled from the switchboard, and with supplementary electrical governors.



Parsons Turbine and Dynamos; Camp Generating Station.

In front of the switchboard a booster-balancer is situated, consisting of four machines mounted on one shaft, and running at 480 revolutions per minute.

This combination is capable of dealing with 100 amperes out of balance, and can boost 100 volts when carrying 220 amperes, and was built by the India-Rubber, Gutta-Percha and Telegraph Works Co., of Silvertown.

Situated in a well, 11 ft. 6 in. below engine room floor level, and clearly in view of the switchboard, are two Wheeler Admiralty-pattern surface condensers, each of which can deal with 350 KW. A 24-in. main exhaust pipe of $\frac{3}{8}$ in. galvanised riveted steel, running in a 6 ft. passage under the engine room floor, is carried over the condensers and

through the end wall, passing vertically up the end of building as an atmospheric exhaust, Blake Knowles automatic relief valves being provided in case of a failure in the vacuum. The arrangement of condensers, main exhaust,

E.P.S. Battery; Camp Generating Station.

relief valves, and a 250 KW. turbine set with exhaust valve, are clearly shown in one of our illustrations.

At the end of each condenser is situated a combination consisting of a 6-in. Gwynne centrifugal pump running at 860 revolutions per minute, and used for circulating purposes, a triple-throw Edwards air pump (8 in. × 8 in.), running at 150 revolutions, and a triple-throw lift pump ($3\frac{1}{2}$ in. × 6 in. stroke) at 60 revolutions per minute. The various pumps are driven by a Siemens four-pole shunt motor of 17 B.H.P., the centrifugal pump being direct-coupled, and the air and lift pumps driven through clutches and reduction gearing, the complete sets being supplied by Messrs. Hayward Tyler & Co. A 6-in. air-pump discharge is led into a hotwell of 600 gal. capacity, situated in one corner of the basement. From here the hot water is pumped by the lift pump through a Kennedy meter and 3-in. delivery pipe into the feed tank over the pump room.

Bye-pass valves are provided on the delivery of the lift pumps, which operate in cases of mishap. Two vacuum gauges are provided on the end wall, in full sight of the switchboard.

The circulating water for condensing purposes is obtained from a cooling pond 200 ft. × 100 ft. × 6 ft. deep. This pond can be filled from the Government's camp supply, but normally the make-up is supplied by the roof water from some adjacent buildings. The pond is constructed of concrete, and rendered water-tight by a lining of Callender's bitumen, with a cement facing.

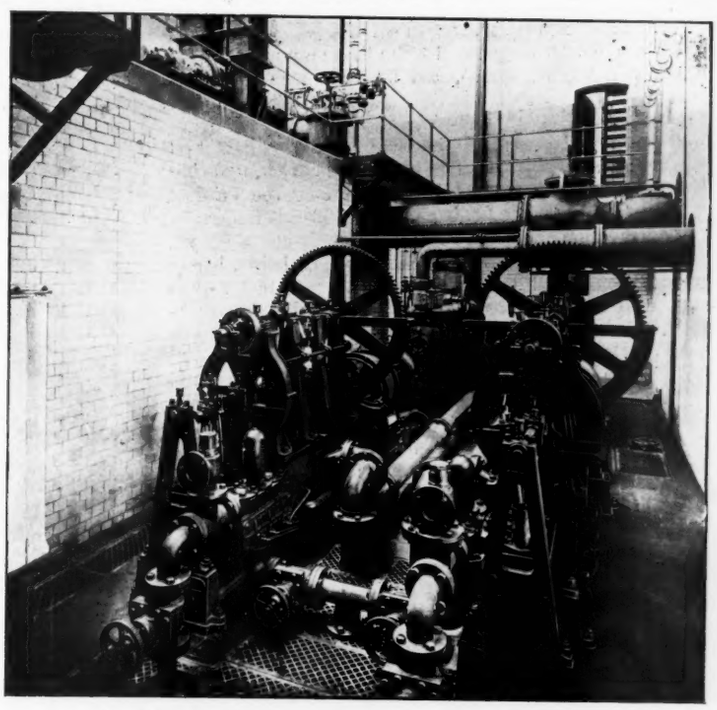
A battery-room 43 ft. square is provided behind the switchboard and contains 230 E.P.S. lead cells, having a capacity of 1,000 ampere-hours. The building is well lighted, and provided with a sink for filling and washing.

The switchboard has been constructed by Messrs. Siemens Bros. & Co., Ltd., the panels being of white marble. It is mounted on a gallery of fire-proof construction, about 6 ft. above engine room floor level, and extending some 40 ft. from the condenser basement towards the offices at the other end, with which it is directly connected by a flight of steps. At one end of the board are 14 feeder panels equipped with ammeters and pilot voltmeters, throw-over switches for connecting either of two sets of bus-bars, which have been provided owing to the possibility of having to supply distant feeding points with a higher voltage, the board being designed for this end, also main switches and enclosed fuses.

In the centre of the board is the balancer panel, with + and — battery panels on either side, and at the other end of the board are four generator panels, a spare panel, condenser and feed pump motor panels, and a station-lighting panel. On the battery panels handwheels with through spindles operate the battery regulating switches at the back.

On the balancer panel a Kelvin and White recording ammeter and automatic cut-out is provided for recording the earth current up to 20 amperes, the neutral bus-bar being earthed through a permanent resistance; in the event of the above current being exceeded the ammeter is, by means of the cut-out, automatically replaced by a resistance. On the generator panels the main circuit breakers are automatically locked by the field-making switches, the machines being excited from the bus-bars, so that it is compulsory to make the field before switching in a generator and break after switching out.

The speed of the engines may also be controlled from the generator panels. A small handwheel on the front varies a resistance in circuit with a solenoid controlling the stroke of the relay plunger on the turbine and the amount of steam which is admitted. The switchboard man is therefore in a position to control and see his generating and condensing plant and his battery without leaving the board, at the back of which windows open into the battery room. Watt-hour-meters for measuring the output to the feeders and the station consumption are fixed on the wall below the switchboard platform. A 6-ton hand-travelling crane is provided over the engine house, made by Messrs. T. Smith & Co., of Rodley.



Condensing Plant; Camp Generating Station.

The distribution is carried out through 14 lead-covered paper-insulated cables, occupying 43 miles of trenches, and

laid solid in stoneware troughs with covers, iron troughs and covers being laid under roads. There are 32 feeder pillars at various points in the ring mains which are laid in each camp.

Inside the pillars, mounted on a slate base, are three sets

Babcock & Wilcox Boilers; Camp Generating Station.

of bus-bars, connected at the bottom to the three cables of the three-wire system, the outer, + and − bars, being divided and a watt-hour-meter inserted in series to measure the output of the branch distributors which lead from their upper portions, the main distributors, pilot wire, &c., being connected to the lower halves. The main distributing ring in the North Camp consists of ·156, ·156 and ·078 sq. in. section cable 3,200 yards long, and the ring in the South Camp is 2,780 yards long, of ·125, ·125 and ·062 sq. in. section cable. The longest feeder is 1,950 yards in length, of ·532, ·532 and ·206 sq. in. section cable.

At the present time some 16,000 lights are provided for (14,000 points being wired), and 32 10-ampere Crompton double carbon arc lamps, each being supplemented by a pair of incandescent lamps for all-night lighting, are provided in the Queen's Avenue. A certain number of the original oil lamp standards are in use for side street lighting, a fitting containing two incandescent lamps replacing the original lamp. These lamps are fed by a special 400-volt feeder.

There are motors of about 100 H.P. already connected up, and used for bread-making machinery, sack hoists, baling presses, passenger lifts, &c.; the number of motors will increase in the future, as the small steam engines are superseded. Messrs. Siemens Bros. & Co., Ltd., were responsible for the cable work.

Some idea of the work involved in arranging the scheme will be gathered from the fact that there are in the Marlborough Lines barracks for five battalions of line regiments and Royal Artillery, married soldiers' quarters, the Connaught Hospital, a church, and midway between the camps a gymnasium, swimming baths, Government House, the residence of the General Officer Commanding the 1st Army Corps, the residences of the Quartermaster-General and General Officer Commanding the Royal Engineers.

In the Stanhope Lines there are barracks—some containing 35 blocks of buildings in themselves—for each of five battalions of line regiments, and for Royal Engineers, Army Service Corps, and Royal Army Medical Corps, with numerous married soldiers' quarters. There are also the Headquarters Staff buildings (1st Army Corps), three churches, Army Veterinary and Signalling Schools. Altogether, there were 95 types of buildings in the Stanhope and 75 in the Marlborough Lines, requiring separate wiring designs.

In all cases service boxes fixed outside the buildings are used, containing main fuses and frequently switches. In the latter case, which occurs in all barrack buildings, an N.C.O. switches on or off the all-night lights in corridors, &c., and the barrack room lights by means of key switches. Here, and in all cases of bare inside walls, screwed steel conduit is used for the wiring, the conduit being earthed on to the lead outers of the cables which are earthed on to the feeder pillars.

Whether from economical motives or otherwise, the illumination provided is comparatively small—in fact, a barrack building containing 100 men has only 26 lamps provided, some being less than the normal 16 C.P., and in many of the married quarters a mile of wire had to be run for the purpose of supplying 66 lights only.

When under the makers' test, the larger turbines showed a steam consumption at full load of 24·9 lbs. per KW.-hour, with a vacuum of 26·75 in., and 131 lbs. stop-valve pressure, while at half and quarter loads the figures were 29·4, and 37·7 lbs. respectively. The smaller set with a similar pressure and vacuum showed a full-load steam consumption of 27·82 lbs. per KW.-hour.

The whole of the work has been carried out successively under Col. Pitt, R.E., and Lieut.-Col. H. J. Jerome, R.E., C.B., Commanding Royal Engineers, South Aldershot, during the period of construction.

On behalf of the War Office, Major Stuart, R.E., Major Baylay, R.E., and Captain Dumaresq, R.E., have successively acted as advisers, while on Mr. A. J. Mayne, chief electrical engineer, and his assistants, Messrs. Codd and Collard (on the civilian staff appointed by the War Office), has devolved the actual carrying out of the work, the design and execution of which reflects great credit on all concerned.

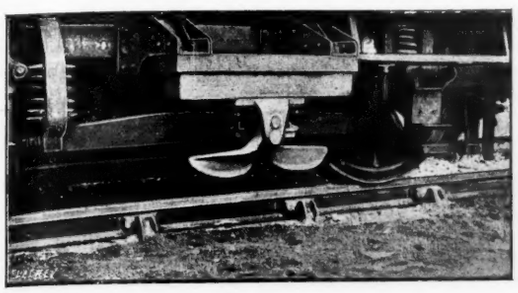
FRENCH SUBURBAN ELECTRIC RAILWAYS.

THE march of progress in suburban railway traction, which has caused the majority of the English companies concerned, to seriously consider the merits of electricity as

View of Third-Rail Construction; Paris—Versailles Railway.

opposed to steam for motive power purposes, has in similar manner affected the Western Railway of France. In this connection the *Street Railway Journal*, of New York, gives some interesting particulars, also a number of illustrations, some of which we reproduce.

The company last year carried out experiments on its lines in the vicinity of Paris, and eventually



Type of Third-Rail Shoe.

adopted a third-rail system of electric traction for its line between Paris and Versailles. The route, which is 11 miles long, and double-track, runs along the bank of the Seine for a portion of the distance, and includes 1½ miles of viaducts and a tunnel 2 miles in length. The city terminus is in the main Invalides station of the company, and the many advantages of being able to work its trains either by steam or electrically, led the company to favour the adoption of electric locomotives. For this reason, the original equipment consisted of 10 electric locomotives, which were constructed by the Société Anonyme de Locomotion Electrique, of Paris. The company has, however, recently tried some motor-cars of a similar type to those in use on the Paris Metropolitan Railway. These cars have Sprague and Thomson-Houston outfits, and single reduction motors.

Energy for the line is supplied from the power station at Moulineaux, from which three-phase current at 5,000 volts is delivered to sub-stations on the route, and there converted to direct current at 550 volts for use on the line. The locomotives were to be powerful enough to draw 200-ton trains at speeds of 31 miles per hour on the maximum grade, and 62 miles per hour on the level.

French railway law compels all passenger trains to include one baggage-car, which must be in front of the passenger coaches; and the locomotive builders hit upon the idea of combining the locomotive and baggage-car, and thus utilising the weight of the baggage for adhesive purposes.

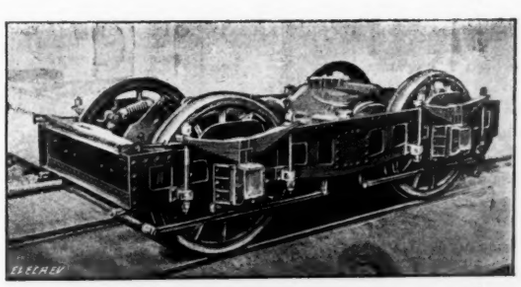
The locomotives were, therefore, built with a centre baggage compartment, and end compartments reserved for the controlling apparatus, so that the locomotive can be operated from either end. The car body is 42 ft. 7½ in. long, and is built of wood sheathed with iron. It is mounted on bogie trucks, having wheel bases of 8 ft. 6 in., and wheels 44 in. in diameter.

Six of the locomotives are equipped with gearless motors of Westinghouse and Brown-Boveri make, and four with single reduction motors of the Thomson-Houston type, a motor being used to each axle. With a view to minimising the hammering action on the track which is frequently noticeable in tramway cars at low speeds, and which in the case of a heavy locomotive and higher speeds, would be greatly accentuated, the company decided on flexibly suspending the motors in all cases. The gearless motors were mounted directly on a hollow shaft, the internal diameter being larger than the axle, which passes through it. Power is transmitted from the motor to each wheel, through six coil springs, which are connected at each end respectively to a triangular plate crank on the ends of the hollow shaft, and to three bosses cast on the wheels between the spokes, this method being also adopted in the case of the geared motors.

The gearless motors have six poles, and exert a normal tractive effort of 600 kg. per motor on the wheels at a speed of 530 revolutions per minute, and a maximum tractive effort of 1,500 kg. Both arrangements of motors are operated on the series-parallel system.

Suburban Train Hauled by Electric Locomotive: Paris—Versailles Line.

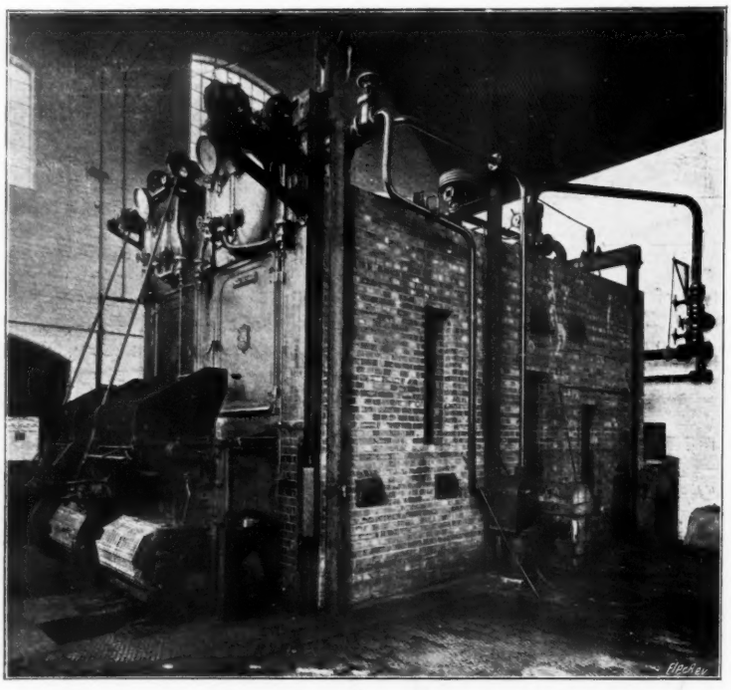
The arrangement of track and third-rail system employed is as follows:—



Truck with Geared Motors.

Each joint is bonded by two protected copper bonds, having a total cross-section of 600 sq. mm. The third rail itself is supported in iron chairs, which maintain the top at a distance of 23½ in. from that of the service

rail and 8 in. above it. The chairs are similar in general style to those used in standard railroad construction in France, and are composed of a casting which embraces the base of the rail and extends halfway up the web. The rail being held in place in the chair by means of steel springs. The springs used on the third rail are, however, lighter than those used on ordinary track work. The chairs are mounted on wooden insulators, to which they are held by lag screws. The base of the chair is made broad enough to extend on top of the wooden insulator so as to shed the water from it. The third rail is divided into electrical sections by short wood filled gaps. It is also protected at certain points where there is danger of accidental contact, by two wooden guards and is painted red as a danger signal. The third rail itself weighs 92½ lbs. per yard.



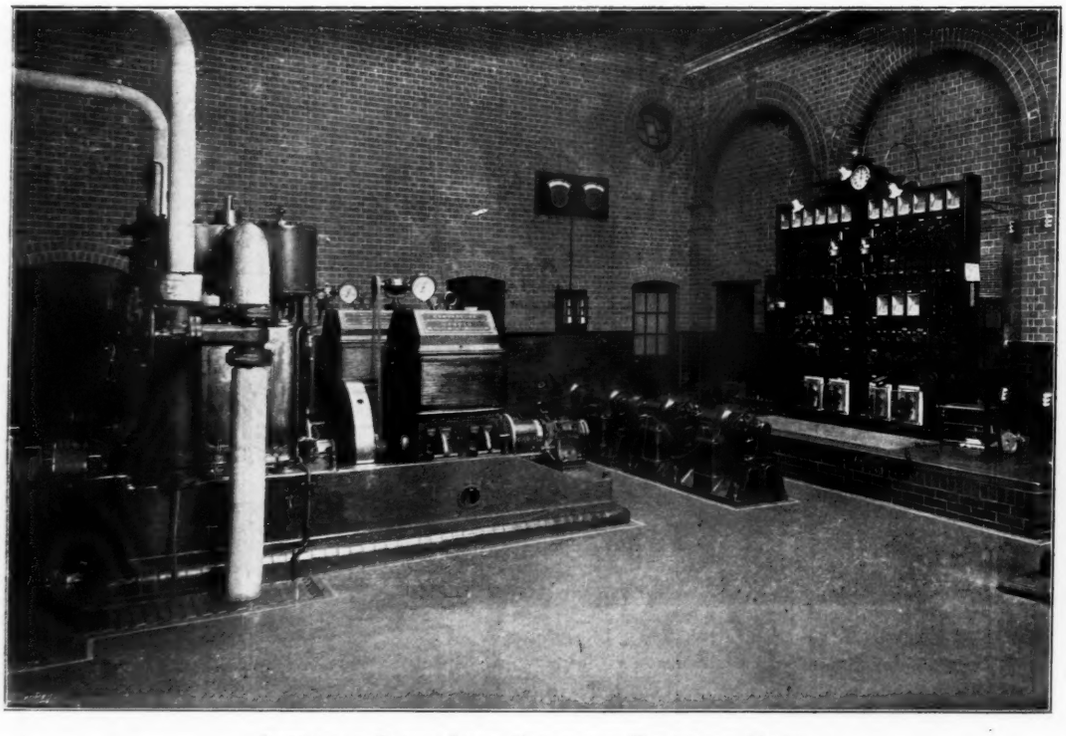
Boilers and Stokers; Twickenham Electricity Works.

With a view to accelerating the laying of the third rail, three ordinary gondola cars were coupled together to make the length necessary for transporting the rails, the end cars being fitted with a U-shaped crane. On the top member of the crane was a travelling hand-hoist, by means of which the rails were lifted from the cars and lowered into position in the chairs.

TWICKENHAM ELECTRICITY WORKS.

In 1900 Messrs. Edmundson's Electricity Corporation obtained a provisional order for the electric lighting of Twickenham, on behalf of the Urban Electric Supply Co. Designs for the station were got out by Messrs. Edmundson, and in November, 1901, building operations were commenced. In order to supply some extensive illuminations for the Coronation in June last, a temporary iron shaft was put up, and, by dint of much hard work for all concerned, a supply for the illuminations was given in good time. Twickenham being outside London the festivities were not postponed and the electrical illumination of the Town Hall was admired by the crowds, and proved an excellent advertisement. A continuous supply was given towards the end of July, and this has been continued since without interruption.

The buildings, the contract for which was placed in the hands of Messrs. T. J. Messon & Co., of Twickenham, consist of a main building, containing the engine room and boiler house, and an extension of the same in two stories



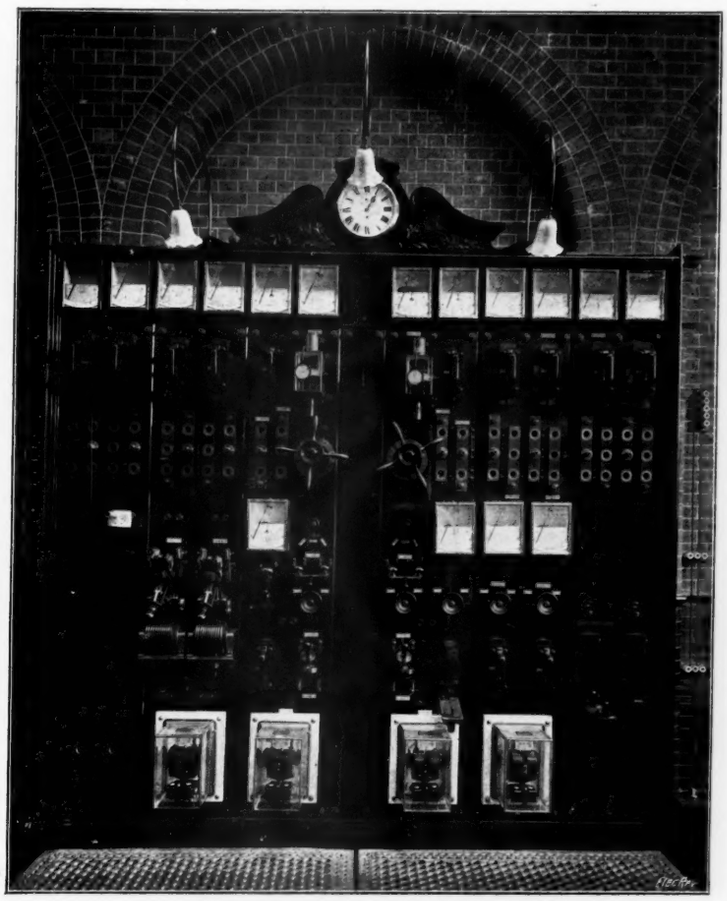
Interior of Engine Room; Twickenham Electricity Works.

containing battery rooms, general offices, &c. The shaft is 110 ft. high, lined 30 ft. up with firebrick. A well has been sunk, which gives a water supply amply sufficient for the working of the boilers, rendering the station independent of the water company, except, of course, as a stand-by.

The boiler house contains two Babcock & Wilcox water-tube boilers of 1,218 sq. ft. of heating surface. Mechanical chain grate stokers are fitted, driven direct through worm gearing by a 1-H.P. motor. The boilers are fitted with superheaters of the usual Babcock and Wilcox type.

Two vertical double-acting feed pumps, by Hall, of Peterborough, are installed; supplied with water raised to boiling point by means of a Boby heater detartariser utilising the exhaust steam from the engines.

The pipe work is so arranged that the pumps can either pump direct from the well to the boilers or from the well to the water tanks, or again, from the tanks to the boilers *viâ* the heater, or direct.



Main Switchboard; Twickenham Electricity Works.

The engine room contains two Belliss two-crank compounds of 135 B.H.P. direct coupled to Parker (two-pole) dynamos of 90 KW. capacity each. These machines give 480—530 volts across the outers of the three-wire system. The balancing is done by a combined balancer booster, capable of dealing with an out-of-balance load of 90 amperes, and so arranged as to automatically raise the E.M.F. on the overloaded side 1 volt for every 10 amperes out of balance.

The boosters give 66 amperes at 85 volts for charging the battery. The battery consists of 260 D.P. cells arranged in two stories, 130 cells on each floor. At the end of each row of cells is a multiple switch wired to the cells in that row and connected to a voltmeter, thus enabling the regular logging of each cell to be done with a minimum of trouble. The capacity of the battery is 192 KW.-hours, with a maximum discharge rate of 100 amperes for one hour.

The switchboard, which is of Edmundson's standard design, was supplied by Mr. E. Charrington, and carries the necessary switches and instruments for the regulation of the two dynamos and the booster balancer set.

Provision is also made on the board for another generating set. It is gratifying to learn that the demand in Twickenham is growing so rapidly, that this extra set of 200 KW. is already on order, and is about to be erected. The feeders and distributing network consist of Callender's vulcanised bitumen cable laid solid with bitumen in wooden troughs covered with earthenware tiles.

Arrangements are being made for a supply to the urban districts of Teddington and Hampton. This will, of course, mean large extensions, and for this reason only temporary ends of corrugated iron have been put to the engine room and boiler house.

The resident engineer is Mr. C. E. Hume, who has supervised the building operations from the start and erected the whole of the plant.

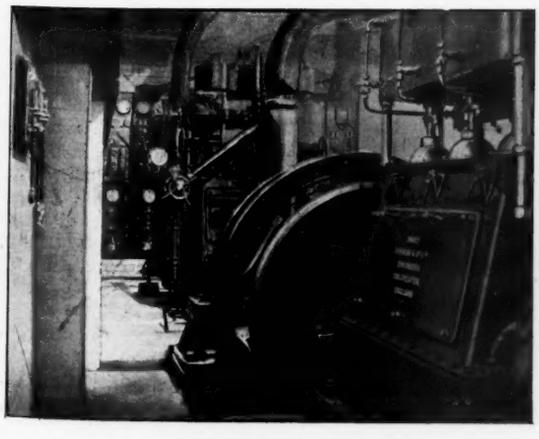


Fig. 1.—View of Engine Room, Baltic Exchange.

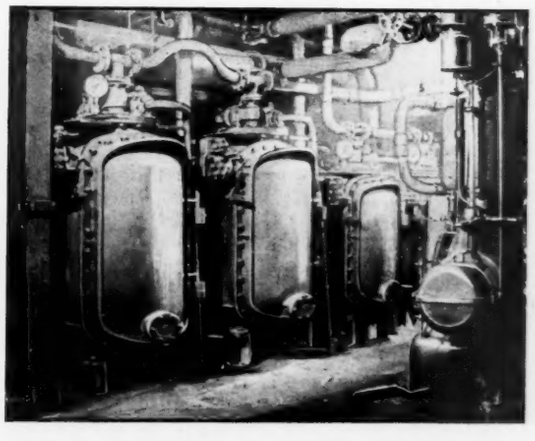


Fig. 5.—View of Calorifiers and Air Compressor; Baltic Exchange.

In Twickenham, as in all the other towns supplied by Messrs. Edmundson, no inhabitant who wishes to be up-to-date can possibly help having the electric light in his house, so many and varied are the ways which Messrs. Edmundson have devised to suit the means or convenience of the

prospective customers. The wiring will be done for him, either on the free-wiring system with a rental per lamp and option of purchase, or on a very easy hire-purchase system, or he may buy his installation outright. Again, he can elect to pay for his current, either on a maximum demand system, or on a flat rate. Nor is the working man neglected, for he can get his house wired free of any charge, and pay through a slot meter a rate of 7d. a unit, which covers everything. A man who, with all these different methods before him, neglects to have *the* light in his house must surely be a very benighted heathen—or else have shares in the gas company.

THE BALTIC MERCANTILE AND SHIPPING EXCHANGE.

The following particulars and illustrations relate to the very large installation of electrical, pumping and ventilating machinery erected in the magnificent buildings of the Baltic Exchange, which was opened by Sir Marcus Samuel, the Lord Mayor, on April 21st.

The electrical portion consists of between 6,000 and 7,000 lamps, fed and controlled from the engine room by six main

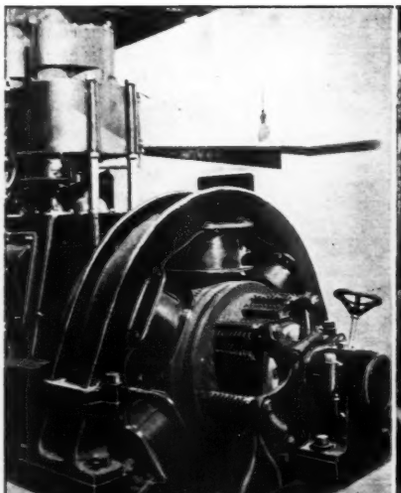


Fig. 2.—Crompton Multipolar Dynamo.

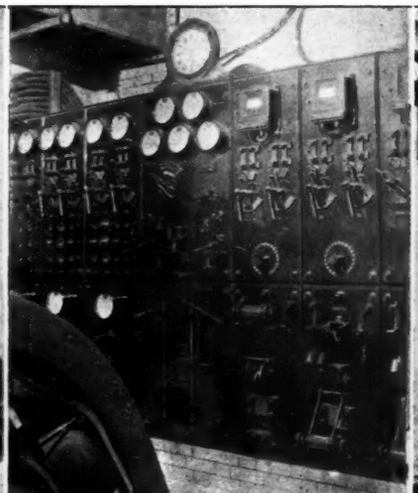


Fig. 3.—View of Main Switchboard.

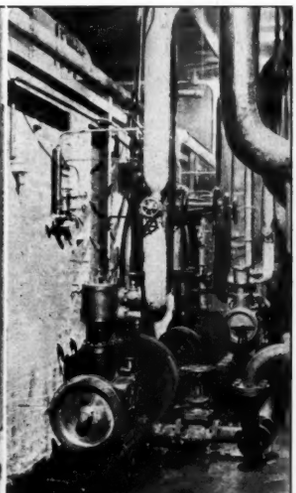


Fig. 4.—Circulating Pumps.

circuits of 37/12 cable, and about 80 distributing circuits, on the two-wire system. All the cables and wires are of Henley's lead-covered paper-insulated type, and are run in screwed iron conduits and water-tight junction boxes. This part of the work has been carried out by Messrs. Donnison, Berlyn & Sillem, of Great Portland Street. The electric light fittings, which are most artistic, were specially designed and made by Messrs. Wm. Soutter & Sons, Ltd., of Birmingham, through their London house, represented by Messrs. J. J. Smith & Co., and embody in their designs all sorts of marine animals, plants and implements, from cockles to anchors and octopi; the latter form the bases of the arc lamp reflectors in the exchange, which is illuminated entirely by light reflected upwards, and again reflected from the ceiling.

The electrical plant consists of three 140-H.P. three-crank Peache engines by Messrs. Davey, Paxman, coupled direct to 88-KW. multipolar dynamos by Messrs. Crompton & Co.; these give each 800 amperes at 110 volts, 420 r.p.m., and work without condensing. The main switchboard is fitted with minimum current cut-outs, main switches and fuses on the generators, three positive bus-bars to enable the generators and battery to be run on separate circuits, or in parallel, as required, a duplex switch fuse on each pole of each main circuit, and a full equipment of ammeters and voltmeters. The battery panel carries, in addition to the instruments and booster switchgear, a charge and discharge switch and a Crawley automatic switch. The switchboard and the motor-booster were supplied by Messrs. Crompton.

A set of 56 41-plate Chloride accumulators, with a 600-ampere discharge for one hour, completes this section of the installation.

There are three boilers, of the multi-tubular marine type, 14 ft. long by 9 ft. in diameter, which supply steam for the electrical plant, pumps and compressor; the latter forces air at 100 lbs. per sq. in. to a depth of 450 ft. below the sub-basement, and raises water from that depth to large storage tanks, which are capable of holding 75,000 gallons, and can be filled in less than two hours.

The boilers are fed by two Weir pumps; two "Empire" pumps by the same makers pump the water from the storage tanks to the supply tanks on the roof, and also supply the fire hydrants. A Bennie feed-water heater is provided, which receives the exhaust steam from the engines.

The ventilation system is most elaborate and efficient, and consists of four fans, 8 ft. in diameter, direct-driven by four high-speed two-cylinder engines made by Messrs. Alley and MacLellan. These fans draw air through inlet ducts into chambers fitted with canvas screens, over which water is constantly circulated by Worthington pumps, thus cleansing the air from impurities before it enters the discharge ducts and passes through the ventilating grids into the Exchange and the numerous offices. The vitiated air is extracted through the outlet ducts by 15 electrically-driven fans, fixed on the roof, and controlled entirely by switchgear in the engine room.

The air is heated by large batteries of radiators, through which hot water is circulated by a series of pumps; the water can be heated by steam, direct from the boilers, or by the exhaust steam from the engines, in five "calorifiers," several of which are shown in one of our illustrations.

The back pressure due to the use of the exhaust steam for heating the buildings and the hot water supply is controlled by a valve in the main exhaust pipe, and will not exceed 2 or 3 lbs. per sq. in. The water for the radiators and lavatories is circulated by means of a number of small Alley & MacLellan steam engines driving centrifugal pumps.

As several strong springs were tapped in excavating for the sub-basement and foundations, which are below the sewer level, pumps of both steam and electrically-driven types have been provided; these pump the water into automatic tanks, which discharge it into the sewers.

The elevators are all electrically-driven, with the controlling gear in the cages, and were constructed by Messrs. Waygood & Otis. A complete cold storage plant has been fitted by Messrs. Hall, of Dartford, with steam-driven refrigerating machinery.

There are about 200 tenants already in occupation, all of whom use electric light. Chamberlain & Hookham meters have been used throughout.

Messrs. Burn Bros. are responsible for the heating and ventilating plant; Mr. Adrian Collins, A.M.Inst.C.E., of the firm of Miller & Collins, consulting engineers, designed

the electrical installation, and, in conjunction with Mr. W. R. C. Wakley, A.M.I.E.E., the chief engineer, has superintended the erection on behalf of the Baltic Exchange.

The electrical plant affords no opportunity for criticism, being well made and installed in first-class style; we must, however, deplore the neglect of the possibilities of electrical driving in connection with the pumps and fans. With ample electric power at hand, steam engines to drive small centrifugal pumps, and even the larger pumps and fans, are hopelessly out of place, to say nothing of the waste of steam in the innumerable pipes, and the saving which could have been effected in the working of the plant and in the annual cost of repairs. The sooner this is realised, and electromotors substituted for most of these engines, the better it will be for the proprietors and for the staff.

ELECTRIC TRACTION NOTES.

(*Continued from page* 918.)

St. Helens—Liverpool.—A regular passenger service between St. Helens and the Pierhead terminus of the Liverpool electric tramways has now been inaugurated.

Southampton.—At last week's Council meeting, the Tramways Committee submitted the accounts of the tramways undertaking for the past year, showing a net profit of £11,890, of which £5,000 had already been carried to the borough fund in relief of rates. Proposals for the appropriation of the available profits were recommended. A statistical statement showing the results of the working during the whole period that the Corporation had had control of the tramways was presented, from which it appeared that the gross receipts had increased from £17,000 to £52,000. The gross profit had increased from £3,000 to £20,000. Over 9,000,000 passengers were carried last year, and since the Corporation has had the trams nearly 20,000,000 passengers have been carried without one fatal accident. The offer of the Yorkshire Insurance Co. to insure the workmen under the Workmen's Compensation, &c., Acts at 5s. 6d. per cent. was accepted.

Swansea.—The T.C. has instructed the borough surveyor and electrical engineer to forthwith complete plans and specifications for the overhead system of tramway authorised by the order of 1902.

Wolverhampton.—In the course of the debate on the Lorain trams with the T.C. last week, the Mayor (Alderman G. B. Thorne) read a letter which he had received from the borough electrical engineer, Mr. Shawfield, giving the following particulars:—

"If the Lorain maintenance costs are estimated on the present type of contact plates and granite casings, the extra cost of the Lorain system above the overhead will be 1·89d. per car-mile = 80 per cent. With the improved type of contact plate and with the present granite casings the extra cost will be ·813d. per car-mile = 35 per cent. With the improved form of contact plate and improved granite casings the extra cost will be ·573d. per car-mile = 25 per cent. The extra annual cost will be approximately as follows:—

	At 1·839d.	At ·813d.	At ·573d.
On routes in operation ...	£4,088	£1,810	£1,277
On remainder of routes ...	£5,440	£2,410	£1,760
	£9,528	£4,220	£2,977

If the existing form of contact plates and granite boxes were retained on the 11·375 miles of single track now in operation, and future routes were equipped with the improved types, then the cost would be as follows:—

Routes at present in operation (at 1·839d. per car-mile)	£4,088
Remainder of routes (at ·573d. per car-mile) ...	£1,700
	£5,788"

The Mayor added that for the purpose of complete comparison, to each of these totals must be added the increased annual payment in respect of interest and sinking fund, due to the large excess of the initial cost over and above the overhead system, amounting to £1,450. When this is done Mr. Shawfield's lowest figure, £2,977, mounts up to £4,427. Alderman Mander, the chairman of the Tramways Committee, made reference to the ELECTRICAL REVIEW during the debate. He said it had been stated that he had prophesied they would make £20,000 profit by the Lorain system. Alderman Lewis said that on May 6th, two years ago, the Alderman stated that 1s. per car-mile would give £20,000.

A representative of the *Express and Star* has interviewed Mr. Wetmore, the representative of the Lorain Co. in Wolverhampton, respecting the position that has been created by the demand of the Council. "My object in desiring this interview," said the representative, "is to ask you whether, without prejudice, and without any breach of confidence on your part, you would give me your own personal views as to the light in which the company will now regard the question between themselves and the Corporation." "That," replied Mr. Wetmore, "is a matter which I must decline to discuss with you." "I suppose," said the interviewer, "should the question ultimately come to arbitration between you, the company will contend that they have fulfilled the contract into which they entered with the Corporation?" "No," he replied, "we have not fulfilled our contract yet, but we mean to fulfil it. There are certain conditions yet to be carried out, and then——" "And then," the interviewer ventured to add, "I suppose the Corporation will have to face the music?" "Well," replied Mr. Wetmore, "that has to be seen. If," he added, "the Lorain system of trams is discontinued, Wolverhampton some morning will have a very rude awakening." Continuing, the *Express* representative said, "The great point, to my mind, seems to be this: Your Lorain system has given the fullest satisfaction to everybody except on the point of finance. It has not proved a 'commercial success.'" To this, however, Mr. Wetmore made no response, and the interviewer proceeded: "I suppose your argument would be that the fact of the Lorain system in Wolverhampton not having proved a 'commercial success' is no fault of the company? In other words, that it is the lack of sufficient population on the side of Wolverhampton where the cars have been running which is responsible. Had there been a larger population to use the trams, they might have been worked with success, and probably realised a slight profit." Mr. Wetmore remarked, "That has nothing to do with our company. It doesn't matter to us whether Wolverhampton makes a profit or a loss. A great deal will turn on those words, 'commercial success.' Those words in the agreement are strictly defined; in fact, there is more than a whole page in that agreement devoted to making the meaning exact and sure; and by that definition both sides will be bound."

"What about the question of offering the Corporation better terms? You know, Mr. Wetmore," said the interviewer, "there is a very strong feeling in Wolverhampton that if you could offer more reasonable terms, so as to reduce the cost of installation and maintenance of your system to such an extent as to throw no burden on the rates, the Council might be induced to reconsider the position." Mr. Wetmore replied, "I have already made an offer to the Tramways Committee, and they have not replied to my letter."

TELEGRAPH AND TELEPHONE NOTES.

Bray Telephones.—The Council has decided to inform the National Telephone Co. that, unless additional trunk wires are laid between the Bray and Dublin exchanges, it will not grant wayleaves for connecting any more local subscribers.

Cambridge Telephones.—The T.C. on May 21st received the report of Mr. A. B. Bennett *re* a municipal telephone system. He states that as the area contains only some 30 square miles, it can be installed and worked economically. His estimate is £10,800 for 600 complete subscribers' lines, and £2,400 for extra pipes and pole accommodation, &c., for 600 additional lines. He has no hesitation in recommending the Council to apply for a license. The Council adopted the report.

International Cable Service.—On May 11th last the cables between Balikpapan (Borneo) and Kwadang (Celebes), and also between Kwadang and Menado (Celebes), and the landline from Kwadang to Sorontalo, were opened to international service.

International Telegraph Conference.—The ninth International Telegraph Conference was opened on Wednesday morning by the Postmaster-General, Mr. Austen Chamberlain, M.P., at the Examination Hall of the Royal Colleges of Physicians and Surgeons, Victoria Embankment, W.C. The following States were represented:—Argentine Republic, Austria, Belgium, Bosnia-Herzegovinai, Brazil, Bulgaria, Cape of Good Hope, Ceylon, Commonwealth of Australia, Crete, Denmark, Dutch East Indies, Egypt, France and Algeria, Germany, Great Britain, Greece, Holland, Hungary, India, Indo-China, Italy, Japan, Luxemburg, Madagascar, Montenegro, Natal, New Caledonia, New Zealand, Norway, Persia, Portugal, Portuguese Colonies, Rumania, Russia, Senegal, Servia, Siam, Spain, Sweden, Switzerland, Tunis, Uruguay, and the United States. The proceedings were private; but the following official statement has been supplied to the *Times*:—In welcoming the delegates, the Postmaster-General referred to the importance of the matters which they had met to discuss, and wished them success in their labours, which had for their object the amelioration of international telegraphs in the interests of the public. Dr. Hennyey de Hennye, the principal delegate of the Hungarian Administration, responded in eloquent terms to the address of the Postmaster-General, and, as the representative of the Administration which last entertained the conference at Buda-Pesth, gave a *résumé* of the events affecting the International Telegraph Convention which had occurred since the last conference. M. Delarge, the senior delegate of Belgium, and doyen of the conference, followed with a friendly speech; and M. Pereira, the delegate of Portugal, also thanked the Postmaster-General for the welcome which he had extended to the delegates, and joined in the wish that the result of the conference would be beneficial to the telegraph world. The business of the conference will go on from day to day until the end of June. Mr. J. C. Lamb, C.B., C.M.G., the principal delegate of Great Britain, was chosen president of the conference, and Mr. John Ardron and Mr. P. Benton vice-presidents. The following presidents of committees were appointed:—M. Delarge (Belgium), M. Sydow (Germany), M. Neubauer (Austria), M. Bordelongue (France), and these gentlemen are to be assisted by the following vice-presidents:—M. Gvozditch (Servia), M. Sevastianoff (Russia), M. Pop (Nether-

lands), and M. Pereira (Portugal). The secretarial duties of the Conference will be carried out by the International Telegraph Bureau of Berne, which is represented by M. le Colonel Frey, the distinguished director of the bureau, M. Eschbaecher, the vice-director, and M. Homberger. On the nomination of the president, Mr. N. Hautrive, Mr. J. I. De Wardt, and Mr. J. F. Lamb, of the General Post Office, London, were appointed as the British secretaries to the conference.

Mexican Telephones.—An English syndicate is reported to have submitted a scheme to the Mexican Government for the establishment of a system of underground telephone wires in the Federal District of Mexico.

The Paris—Rome Telephone.—The telephone line between Paris and Rome has been experimentally opened, and it is expected that in the course of a few days it will be in regular working order. Cav. Giorgio Rodano, one of the Italian delegates to the International Telegraph Conference now sitting in London, was in Paris last week, and completed the final arrangements with M. Berard, the Under Secretary of State. Telegraph messages in cordial terms passed between Sig. Galimberti, the Italian Minister of Posts and Telegraphs, and M. Berard.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	.. June 20, 1899 ..	..
Trinidad-Demerara No. 1	.. Aug. 27, 1901 ..	..
Dominica-Martinique	.. May 8, 1902 ..	..
St. Lucia-Martinique	.. May 8, 1902 ..	..
Guadeloupe-Martinique	.. May 9, 1902 ..	..
Martinique-Puerto Plata	.. July 10, 1902 ..	..
Cayenne-Pinheiro	.. Aug. 18, 1902 ..	..
St. Vincent-Grenada	.. May 8, 1903 ..	..
St. Lucia-St. Vincent	.. Sept. 19, 1902 ..	..
Reissa-Issa	.. Oct. 22, 1902 ..	..
Reissa-Yemani	.. Oct. 22, 1902 ..	..
Paramaribo-Cayenne	.. Feb. 27, 1903 ..	..
New York-Haiti	.. April 18, 1903 ..	..
Falmouth-Bilbao	.. May 13, 1903 ..	May 24
Landlines.		
Dagua-Buenaventura..	.. May 14, 1903 ..	..

Telegraph Matters.—Mr. Henniker Heaton, M.P., has during the past week submitted a list of 69 postal reforms to the Postmaster-General, among which, affecting telephone and telegraph interests, are the following:—No. 2.—Telegraph tariff to any part of Europe to be 1d. per word. No. 3.—Telephone charges to the Continent to be reduced at least 50 per cent., with a minimum charge of 1s. per message. No. 7.—The cables owned by British companies to be acquired or purchased at market price by Great Britain, India and the Colonies, and then worked at the lowest remunerative rates. No. 8.—Telegrams to all parts of the British Empire to cost 1d. per word with a minimum total of 1s. to Australia and South Africa for each message. No. 9.—Cable messages to Egypt to be reduced from 1s. 7d. per word to a reasonable rate. No. 10.—The cables between England and Spain to be purchased by the Governments concerned and the rate reduced from 3½d. to 1d. per word. No. 42.—All charges for re-direction or retransmission of telegrams to be abolished. No. 43.—The name of each place, &c., in the United Kingdom to be charged in telegrams as one word. No. 44.—Name and address in telegrams free; or 20 words for 6d. No. 45.—All porterage charges on telegrams and guarantees to be abolished. No. 46 —Compensation to be given for telegraphic official errors where loss has occurred. No. 47.—All public telephones to be owned and worked by the State. No. 48. — Telephone calls to all parts of the United Kingdom to be greatly reduced. No. 56.—The Post Office surplus of over £4,000,000 not to be exceeded; all profits exceeding this to be devoted to improving, extending, cheapening, and facilitating postal and telegraphic service. No. 66.—The fee for receipt of a telegram to be reduced from 2d. to 1d. Mr Henniker Heaton also asks that the Postmaster-General be freed from Treasury control, which at first sight would appear to be in effect of burning one's boats, for otherwise where is the money to come from to pay for the cables connecting British territory? We fear that in this respect Mr. Henniker Heaton's voice is as one in the wilderness! There have been "short sections" on hand for years, and will probably remain wrapped up in a Blue Book till another Commission is called. But there is one question we would ask Mr. Henniker Heaton: Why has he forsaken Mr. Marconi? That he must have done so is more than obvious, as in the vast number of reforms there is no mention of the wireless system.

The Telephone System.—A lecture on the above subject, having special reference to the London systems, was delivered last Friday, 22nd inst., by Mr. F. C. Raphael, at the Caxton Hall, Westminster. After a brief historical sketch, the lecturer described in detail the P.O. system in London, and illustrated the subject by lantern slides and working models of the apparatus. The Edison-Bell lawsuit, and subsequent amalgamation, 1879, were referred to; also the Government's decision that the telephone was really a form of telegraph, and could not, therefore, be developed as a public system without a license. The National Telephone Co. was, therefore, taxed to the extent of 10 per cent. of the gross receipts. Statistics, which, as the lecturer said, could be made to prove anything, were given as to the growth of the telephone system in this country. At the present time there are over a quarter of a million telephones connected to public exchanges. Of these, 65,000 are in London. To enable these 65,000 telephones to be put into communication with each other involves some 200,000,000 possible connections. We took the lecturer's word for this, although he got a little mixed in endeavouring to prove it. The details of the P.O. telephone system have already been fully described in this journal, so it is unnecessary to cover the ground again. Mr. Raphael had, in addition to lantern slides showing the general appearance of the inside of the exchange, a working model of the system, with jacks, lamps, &c., and by means of this was able to show clearly the operations involved from calling up and being connected with another subscriber to "ringing off." In the P.O. system there is, as has been previously described, neither "ringing up" nor "ringing off." All the subscriber has to do is to lift his instrument off the hook in order to call up the exchange, and to hang it up again when the conversation is finished. The exchange operator has no bell or indicator drop to attend to, all the signals being by means of small glow lamps. The difference between the number of calls given per subscriber on the "unlimited" call and the payment per call systems, was well emphasised by the statement that on the "unlimited" system one exchange operator could, in London, attend to only 50 subscribers, whereas on the payment system 180 can be attended to by one operator. Some interesting load curves were thrown on the screen, which showed the great difference between the city office conditions in London and New York. In London, the maximum number of calls occurs between 11 and 12 in the morning, the number being 8,500; this very rapidly falls off till 2, and rises between 2 and 3 to a maximum for the afternoon, 7,000, falling very rapidly till 5, then to a minimum about 7. In New York the mid-day gap is much smaller, indicating the shorter time taken for lunch. To improve the London system, the lecturer urged the co-operation of the subscribers, and advocated Government control. He would bar office boys from attending to telephones, and suppress all small exchanges. He further called attention to the facilities offered by the P.O. system, such as telephoning telegrams and letters. The latter, if not exceeding 30 words, cost only 1d. in addition to the stamp. Telephoning an express message costs no more than if the message is handed over a counter. Finally, the lecturer expressed his disbelief in wireless telephony and in automatic exchanges. The lecture was apparently much appreciated by the meagre audience present.

Wireless Telegraphy.—In the House of Commons on May 20th, Mr. Doughty asked whether contracts had been concluded for fitting the light vessels round the coast of the British islands with wireless telegraphy apparatus; and, if not, when they would be completed. In reply, Mr. Bonar Law said:—"Negotiations are in progress for fitting a certain number of light vessels in the London district with wireless telegraphic apparatus. The matter will be pushed on with the least possible delay."

In reply to a question asked by Mr. J. Campbell on 21st inst., Mr. Brodrick said:—"It is not possible at present to calculate the cost of wireless telegraphy in Somaliland. I am aware that the wireless system was tested during the German army manœuvres last year, and, judging from the information received, it did not fail. Several wireless systems have been under trial in Germany, Austria, and the United States, but none appear to have been adopted; the other systems of field telegraphy in vogue in these countries are practically the same as that adopted in the British Army. . . . . We applied to the Marconi Co. to give us the best installation they could for Somaliland, but they were not yet in a position to supply us with the requirements of the field service."

CONTRACTS OPEN AND CLOSED.

OPEN.

Battersea. — June 2nd. Prepayment meters. See "Official Notices" May 15th.

Belgium.—June 8th. The municipal authorities of Gosselies are inviting tenders until June 8th for the concession for the public and private electric lighting of the town. Tenders are to be sent to l'Hotel de Ville, Gosselies, whence particulars may be obtained.

Bradford.—June 13th. Tenders are wanted by the Corporation for the lighting of the Cartwright Memorial Hall. Tenders are wanted by the Guardians for the lighting of the Sanatorium for consumptives at Eastly, near Skipton.

Brighton.—June 8th. The Council wants tenders for 5,400 KW. generating plant at Southwick power station, and 5,000 KW. motor-generator converting plant, together with switchboards, instruments, &c., at North Road power station. See "Official Notices" April 17th.

Burma.—June 26th. The Burma Railways Co., Ltd., wants tenders for an electric light and power plant for the Insein workshops. Particulars, specifications, &c., from C. E. Cardew, locomotive and carriage superintendent.

Colchester.—June 10th. Traction switchboard for the electricity works. See "Official Notices" to-day.

Derby.—June 16th. Rails, tie-bars, points, crossings, excavation and other roadwork, poles, overhead wiring, feeders, and cars for the Corporation tramways. See "Official Notices" to-day.

Edinburgh.—June 1st. The Council wants tenders for electric wiring at the North-West extension, City Chambers. See "Official Notices" May 15th.

France.—June 9th. Tenders are being invited until June 9th by the French Post and Telegraph authorities in Paris for the supply of a quantity of telephone cables in five lots. Tenders are to be sent to Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris, whence particulars may be obtained.

Glamorganshire.—The Penrhikyber Navigation Colliery Co. is inviting tenders for the supply of electric lamps and fittings. Particulars of the Secretary, Penrhiwceiber R.S.O., Glam.

Gloucester.—June 16th. Generating plant (two 200-KW. sets), condensing plant, pipework, switchboard, battery and boosters for the city light railways. See "Official Notices" May 8th.

Gloucester.—June 16th. Rails, permanent way, cables, pillars, poles, overhead work, cars, trucks, and equipments, for the City Light Railways. See "Official Notices" May 22nd.

Huddersfield.—The Electricity Committee has decided to advertise for tenders for one vertical jet condensing plant with pipes, tanks, &c.

Hungary.—May 31st. Tenders are invited by the municipal authorities of Veszprem for the lighting of the town either by gas or electricity.

Hungary.—August 31st. Tenders are being invited until August 31st next by the municipal authorities of Besztercsebanya (Neusohl) for the establishment in the town of a central electricity generating station of a capacity of 500 H.P.

Italy.—June 10th. Tenders are being invited until June 10th by the Mediterranean Railway authorities for the supply and erection of a 10-ton electric crane at the railway station at Florence.

Johannesburg.—June 15th. Rails, points and crossings, tie-bars, &c., for the electric tramways. See "Official Notices" May 1st.

Leeds.—June 8th. Messrs. Graham, Morton & Co., Ltd., want tenders for a private telephone installation at their new works. See our "Official Notices" May 22nd.

Littleborough.—June 9th. Electric lighting of Council offices, public library, fire station, &c., together with the necessary generating plant.

Manchester.—June 1st. Stores for the Corporation tramways department. See "Official Notices" May 22nd.

Newport (Mon).—Tenders for cable are wanted by the E.L. & T. Committee. See "Official Notices" May 22nd.

Oldham.—June 2nd. The Electricity Committee wants tenders for supply, delivery and erection of coal-measuring boxes, shoots, &c.

Radcliffe.—May 30th. The Council requires tenders for supply of following plant at electricity generating station:—Contract No. 8.—Steam exhaust, feed and water pipes and accessories; No. 9.—Balancer and motor-generator; No. 10.—Accumulators. See "Official Notices" May 15th.

Rangoon.—July 1st. The Municipal Committee wants tenders for carrying out its electric lighting license, and particulars, forms, &c., can be obtained from the officiating secretary (W. Shircore), Rangoon municipality, at Rs. 75 per set.

Southampton.—June 11th. Low-tension distributing cable. See "Official Notices" to-day.

Southend.—June 15th. 10,000 pairs of flame carbons. See "Official Notices" to-day.

Spain.—June 14th. The municipal authorities of Mora (Toledo province) are inviting tenders until June 14th for the concession for the electric lighting of the town during a period of six years. Tenders are to be sent to, and particulars may be obtained from, El Secretario del Ayuntamiento de Mora (Toledo).

Wood Green.—June 24th. Underground mains, and roadwork for private lighting. See "Official Notices" to-day.

CLOSED.

Bath.—The details given in our last issue respecting the tenders for generating plant are stated to be incorrect. As a matter of fact, we learn that at Tuesday's meeting of the Council the tender of Messrs. Dick, Kerr & Co., Ltd., was accepted for one 500 and one 200-KW. sets. The order for the boilers has been given to Messrs. Babcock & Wilcox.

Battersea.—The B.C. accepted the following tenders this week:—109 arc lamp pillars and brackets, Mackenzie Bros., £1,144 10s.; 112 arc lamps, &c., Gilbert Arc Lamp Co., Ltd., £1,034; 23 arc lamps and brackets for street lighting on the Latchmere Estate, Gilbert Arc Lamp Co, £158.

Bedford.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox for a water-tube boiler at the electricity works, at £1,556.

Belfast.—Messrs. Harland & Wolff, Ltd., of Belfast, have placed a contract with the B.T.H. Co. for a main switchboard for their new generating station, consisting of 64 panels, for controlling the whole of the generating plant and the distributing system for their extensive shipyard. The switchboard, which will be 128 ft. in length, is probably the largest for a private industrial plant in the country.

Brackenbrough, Cumberland.—The following is a list of the tenders submitted for electric lighting and power plant for Joseph Harris, Esq, Brackenbrough, Calthwaite, near Carlisle, to the specification of Mr. Morgan Williams, M.Inst.C.E.:—

	With 17-B.H.P. engine.	With 21-B.H.P. engine.
Ernest Scott & Mountain	—	£2,386 15
Wallace & Watson	£2,352 0	2,385 0
Holmes & Co.	2,219 0	2,254 0
Holmes & Co. (Alternative)	2 191 0	2,228 0
Cox-Walkers	2,146 0	2,179 0
Lowdon Bros. (accepted)	1,972 10	2,002 10

Brighton.—The T.C. on May 21st accepted the tender of Mr H. J. Galliers for installing the electric light, telephones, and fire alarms at the Borough Sanatorium. Messrs. C. G. Reed and Sons, Ltd., whose tender at £217 10s. had been previously accepted, made a mistake of £100, and the Council declined to allow them to amend the tender.

Burnley.—The Corporation Tramway Sub-Committee on May 21st accepted the tender of Messrs. Dick, Kerr & Co., for eight cars at £756 each.

Coventry.—The City Council has accepted the tender of Messrs. Edwin Danks & Co., Oldbury, for supplying two new boilers for the electric light works, for £1,184.

Eastbourne.—The E.L. Committee has received tenders for a 12 months' supply of arc lamp carbons from the following firms:—

De Grelle Houdret & Co. (accepted)	£53 12 0
Crompton & Co.	65 0 0
Sloan Electrical Co.	65 0 0
General Electric Co.	74 0 0
Edison & Swan	74 0 0
Fabius Henrion	76 6 3
Charles Muller	80 5 0
Brush Electrical Engineering Co.	109 13 6

Faversham.—The T.C. has accepted the following tenders in connection with the establishment of electric light works:—Anchor Cable Co., Ltd., for cables, £4,252; Electrical Power Storage Co., Ltd., for battery, £1,072; Mr. Bertram Thomas, for switchboard, £478; British Westinghouse Co, Ltd., for gas engine and producer, £2,355.

Folkestone.—The T.C. has accepted the tender of the Horsfall Co. for the supply of a dust destructor at £6,858.

Govan.—The Lancashire Dynamo Co. has secured the order for two sets of reversible boosters and switchboards for the Council.

Hackney.—The following tenders were received by the E.L. Committee:—

SECTION X.—SWITCHBOARD.

S. Z. de Ferranti, Ltd. (recommended)	£1,792 0 0
Nalder Bros. & Thompson, Ltd.	1,849 10 0
Western Electric Co., Ltd.	1,959 10 0

SECTION Y.—PIPE WORK.

Ashton, Frost & Co., Ltd. (recommended)	£1,450 0 0
E. L. Bas & Co., Ltd.	1,464 10 0
D. Stewart & Co.	1,472 0 0
Babcock & Wilcox	1,561 0 0
J. Spencer, Ltd.	1,568 10 0
Crompton & Co, Ltd.	1,620 0 0

Halifax.—The following tenders were submitted for an electric light installation in New Palace Theatre:—

C. W. Webster, Bradford (accepted)	£675
S. Dixon & Sons, Leeds	787
J. Sunderland & Co., Halifax	815
G. E. Taylor & Co, London	931
R. Dawson & Co., Stalybridge	956
H. Wright & Wood, Halifax	961
Roger Dawson, Ltd., London	997
Blackburn, Starling & Co., Nottingham	1,068
Strode & Co., London	1,181

For electric light installation Haugh Shaw Board School:—

J. Mollett, Halifax (accepted)	£97
J. Sunderland & Co., Halifax	147

Huddersfield.—The Tramways Committee at a recent meeting ordered three standard reversed stairway cars from the British Electric Car Co. at £534 10s. each. The Committee has also accepted the tender of Mr. Ernest Wilton, for the supply of coal for the power station at 6s. 7d. per ton.

The Electricity Committee has accepted the tender of Ferranti, Ltd., for the extension of the switchboard at the electric supply station at £312.

Newcastle.—The Newcastle Electric Supply Co. have renewed their contract for the exclusive supply of motors—both direct-current and three-phase—for the ensuing year, with the British Thomson-Houston Co.

Oxford University.—The tenders sent in for electric wiring at Queen's and Merton Colleges, to the plans of Mr. Morgan Williams, are as follows:—

Queen's College, Oxford.—For mains and electric light wiring for 666 points.

Bergtheil & Young	£2,318
H. M. Leaf	1,770
Hill, Upton & Co.	1,533
Benson & Co. (accepted)	1,476

Merton College, Oxford.—For mains and electric light wiring, Messrs. Hill, Upton & Co.'s tender was accepted.

Preston.—The Tramways Committee has accepted the following tenders for plant for the generating station:—Messrs. Yates & Thom, for Lancashire boilers and superheaters, at £1,591; Messrs. Dick, Kerr & Co., Ltd., for steam engines and dynamos, at £5,916.

Smethwick.—The T.C. has accepted the tender of Messrs. Meldrum Bros. for the supply of a refuse destructor at £9,000.

Southwark.—12 tenders were received this week by the Electric Lighting Committee of the Borough Council for the supply of meters, fuses, sealing troughs and boards. The tender of the Reason Manufacturing Co. for 1·5, 3, 5, and 10 ampere-meters, fuses, sealing troughs, and boards was accepted at schedule prices, as was also that of the Electrical Co., Ltd., for 15, 20, and 50 amperemeters.

Tempsford Hall, Bedford.—The following tenders were sent in for (*a*) electric lighting, power plant, and wiring; (*b*) pumping plant for fire and domestic services, for Lieut.-Col. W. Dugald Stuart, of Tempsford Hall, Tempsford, Bedfordshire, to the specification of Mr. Morgan Williams:—

(*a*)

V. G. Middleton & Co.		£1,795 5
Belshaw & Co.		1,705 15
A. V. Gifkins & Co.		1,548 0
" " " "	(alternative)	1,541 0
H. M. Leaf	(accepted)	1,505 0
Consulting engineer's estimate		1,610 0

(*b*)

	Fire service.	Domestic service.
R. Warner & Co.	£849	£258
A. V. Gifkins & Co.	994	270
H. M. Leaf (accepted)	885	221

Totnes and Devonport.—For an installation of the equivalent of 120 8-c.p. lamps and bells at "Dundridge House," for Sir Robert Harvey, the tender of Messrs. Lord & Shand, Ltd., of Plymouth, has been accepted. For an installation of the equivalent of 195 8-c.p. lamps at "Admiralty House," the Dockyard, for H.M. Admiralty, the tender of the same firm has also been accepted.

FORTHCOMING EVENTS.

Saturday, May 30th.—At 3 p.m. Royal Institution. Prof. S. P. Thompson on "The 'De Magnete' and its Author." (I.—The Book.)

Thursday, June 4th.—At 5 p.m. Royal Institution. Prof. J. A. Fleming on "Electric Resonance and Wireless Telegraphy." (Lecture II.)

At 8.30 p.m. Röntgen Society, at 20, Hanover Square, W. Exhibition by Mr. C. A. Clark of his new Dental X-Ray Tube; paper on "The Electric Field surrounding the X-Ray Tube," by Rev. P. Mulholland, M.A.

Friday, June 5th.—At 5 p.m. Physical Society. Special meeting at University College. Prof. Rutherford, of Montreal, will read a paper on "Radio-Active Processes." A discussion will follow, in which it is hoped that several prominent physicists will participate.

Saturday, June 6th.—At 3 p.m. Royal Institution. Prof. S. P. Thompson on "The 'De Magnete' and its Author." (II.—The Man.)

At 10 a.m. I.E.E. (Students'.Section). Visit to the works of Messrs. Elliott Bros.

NOTES.

The July Tramways Conference at Glasgow.—The Executive Committee of the Municipal Tramways Association of Great Britain has considered the arrangements for the annual conference which is to be held at Glasgow on July 8th, 9th and 10th, and the programme will be roughly as follows:—

Wednesday, July 8th.

10 a.m.—Meeting of Executive Committee.
10.30 a.m.—Reception by the Corporation of Glasgow.
11 a.m.—Conference.
1 p.m.—Luncheon.
2 to 5 p.m.—Conference resumed.
7 p.m.—Dinner to be given by the Glasgow Corporation.

Thursday, July 9th.

9.45 a.m.—Meeting of Executive Committee.
10 a.m.—Business meeting of Association.
11 a.m.—Conference.
1 p.m.—Luncheon.
Visit to Pinkstown power station, car works, &c., during the afternoon.
6.30 p.m.—Association dinner.

Friday July 10th.

Excursion to, say, Campbeltown, per the turbine steamer *Queen Alexandra*.

Reports on the following and other matters will be submitted for discussion, viz.:—(1) Standard form of accounts; (2) Rates of pay, hours of labour, &c., of tramway employés; (3) Permanent way construction.

It has been arranged to invite the following to attend the conference:—The Lord Provost, magistrates and Tramways Committee, Glasgow; representatives from the American Street Railway Association; representatives from the American Street Railway Accountants' Association; representatives from the Union Internationale de Tramways. Mr. Duffy, the auditor of the Chicago City Railway Co., has already been appointed by the Street Railway Accountants' Association, of America, as their representative. Mr. J. M. McElroy, of 55, Piccadilly, Manchester, is the secretary and treasurer of the Association.

Education in Engineering Science.—At a meeting of the North-East Coast Institution of Engineers and Shipbuilders, in Newcastle-on-Tyne, on 23rd inst., a committee was appointed to consider questions which might arise in regard to the education in technical science and general training of youths entering, or preparing to enter, engineering and shipbuilding works. The president, Mr. John Tweedy, of Messrs. Wigham, Richardson and Co., shipbuilders, Walker, said that in America qualified youths were allowed to enter works without premium, but on the contrary, were paid higher wages because of their qualifications. This gave equal opportunities to sons of rich men and poor men, and he suggested that a similar course should be pursued in this country. His firm had determined to make a start. They proposed to admit as pupils without premium, youths who had passed three or four years of an engineering day course at an authorised technical science college, and obtained either an approved certificate or a pass degree in engineering or naval architecture. Those who held no approved college degree, but had passed through an ordinary preparatory school, might be admitted as pupils on production of certificates showing they had passed the matriculation examination required for engineering science at an approved science college or university. Ordinary apprentices would be encouraged to reach the rank of pupils. Mr. Tweedy's scheme was favourably criticised, and it was stated that several employers proposed to follow the example.—The *Times*.

The Fire Congress.—The arrangements for the International Fire Prevention Congress, convened by the British Fire Prevention Committee, which will be opened by the Lord Mayor on July 7th, include the presentation of a number of papers by foreign authorities conversant with special sections of the subject. Applications regarding the programme should be addressed to the hon. general secretary, Mr. Ellis Marsland, 1, Waterloo Place, S.W.

A Monster Motor-Car.—The Vehicle Equipment Co., of Hartford, Conn., U.S.A., has just completed what is claimed to be the largest electrical motor-car in the world. It is a huge char-à-banc, having eight rows of seats sufficient to accommodate 40 persons, including the driver. It has been built for the American Sight Seeing Co., of New York, which hitherto has employed six-horse coaches to convey tourists round New York. The vehicle is driven by means of electrical motors, geared to the rear wheels. Current is furnished by a battery of 44 Exide accumulators of the same size as is used on the company's 5-ton electrical wagons. The controller is adapted to give four speeds forward and reverse, the top speed being 8 miles an hour, at which it is estimated the car will be able to cover a distance of 30 miles on one charge. The char-à-banc is 22 ft. long × 7 ft. in width, and its weight complete is about 3½ tons.

Ferro-Silicon.—A meeting has just been held in Vienna of representatives of 14 concerns producing ferro-silicon by electro-chemical processes, these including the Bosnian Electrical Co., and the Compagnie Générale d'Electro-chimie, of Paris, as a result of which it has been decided to establish a joint office in Paris, through which the output of the various concerns shall be sold. Efforts are also to be made to induce other ferro-silicon producers to join the ring.

Manchester and District Association of Electric Lighting and Power Contractors.—The first annual meeting of this association was held on Thursday, May 14th, when the following officers were elected for 1903-4:—

President.—J. McDermott (Lancashire Engineering Works, Ashton-under-Lyne).

Vice-President.—W. A. Shaw (W. A. Shaw & Co., Stockport).

Secretary.—E. T. Steinthal (G. A. Steinthal, Manchester).

Committee.—J. Dugdill (E. J. Dugdill, Failsworth); G. H. Shaw (G. H. Shaw & Son, Blackburn); J. Vose (Pullin & Shore, Ltd, Bolton); J. Hill (Sharples & Co., Manchester); J. Evans (E. M. Evans, Manchester); H. Coulson-Crawford (Geo. Hill & Co., Manchester).

The report, which was adopted, stated that, following the January meeting of the northern section, the Manchester contractors present asked the local firms to join them in forming an association, and after one or two informal meetings seven firms sent representatives to a meeting at the Lower Mosley Street Schools, where these members formed themselves into an executive committee. During the year the membership has increased to 18 firms. The association at once affiliated itself with the northern section of the National Electrical Contractors' Association, and has sent representatives to the various meetings of the northern section and the central board. A code of rules was formulated and printed for issue among the members. An association device was brought out and adopted by the whole of the N.E.C.A., and the committee hopes it will meet with general use by the members. A system of registration of workmen has been devised by this association, and after discussion has been adopted by the northern section, and is now in use. A slightly different system has been adopted in London; and, after a year's trial of the two systems, it is hoped that a uniform method may be worked out for the whole of the N.E.C.A. An interview was arranged with the Manchester Corporation engineer concerning certain points in connection with the wiring regulations, and the committee have pleasure in reporting that the deputation was very courteously received, and that Mr. Metzger expressed his willingness to work in harmony with the association; and, after some little discussion, the matters raised by the deputation were agreed to by him, and they will be embodied in the next issue of the rules. The question of registration of electrical contractors has been discussed and forwarded to the central board. The committee is of opinion that this is of great importance, and would draw attention to a resolution passed in January last:—"That the members be asked to collect information as to cases where badly-executed work or faulty design has caused serious damage or loss, showing the advisability of having only skilled engineers to carry out contracts, and pointing out any instances supporting the contention that there should be some recognised body of contractors from whom sound work could be obtained. Several minor complaints have been dealt with, and, in one case, a member has benefited materially by the action of the association. The committee would be glad if any such matters could be brought to their notice, with full details, as soon as they occur, as immediate action is essential to success. The question of hours of work and overtime out-of-town rates have been discussed, and certain proposals accepted by the association. These matters have been referred to the northern section for fuller discussion at the next meeting on July 4th.

A New Accumulator Company.—The Accumulatoren-Werke, of Witten, has formed in Manchester the Accumulator Manufacturing Co. (Schulz Patents), which company has the sole right to manufacture stationary and portable accumulators under the Schulz patents in this country. The selling agents are Messrs. Baker, Bauer & Co., of 3, Garden Street, Manchester.

The Electric Railways Bill.—On Wednesday the House of Commons passed a formal resolution to authorise the payment of the remuneration of any persons appointed by the Board of Trade to facilitate the introduction and use of electrical power on railways. The object of the resolution was to enable the House to discuss in committee clause 5 of the above Bill, which has already been read a second time.

Auction Sales.—In our advertisement pages to-day particulars are given of two auction sales, which are to be conducted by Messrs. Fuller, Horsey, Sons & Cassell on June 23rd, of electro-chemical works, plant and machinery at St. Helens, Lancs.

The Mersey Railway Fatality.—At the inquest held at Birkenhead on 19th inst., the coroner explained that the man whose death we mentioned last week, had his skull fractured, but there was no sign of any electric shock, as had been rumoured. Mr. Joshua Shaw, resident electrical engineer for the railway, explained the electrical working of the railway, and stated that it was not possible for anyone to receive a shock through coming in contact with the centre or negative rail, while a shock from the positive rail would not have been dangerous, although it would have been unpleasant. Where this accident occurred deceased could not have received any electric shock. The medical evidence also showed that there were no signs of electric shock. The jury returned a verdict of "Accidental death."

Glow Lamp Tests.—We understand that at the Westminster Electrical Testing Laboratories a "Co-operative lamp test" is being carried out on 40 lamps by 10 makers. The candle-power and efficiency are measured at the start and after 100, 500, and 1,000 hours. The report will be supplied only to subscribers of 2½ guineas, and will not be published. Further particulars can be obtained from the chief electrician, Mr. L. W. Wild, at the laboratories in York Street, Westminster.

London County Council.—At the meeting on Tuesday it was decided to sanction the borrowing by the Islington Borough Council of £5,447 for electric lighting, and to advance £21,000 to the Hampstead Council for similar purposes.

Proposed Trolley Lines.—The Highways Committee reminded the Council of the authority given in 1901 to give notice to the North Metropolitan Tramways Co., of the intention of the Council to put into force the provisions of the lease relating to the introduction of electric traction. Having fully considered the requirements and local conditions of the districts affected, and the difficulties which present themselves on certain of the routes to the adoption of an underground conduit system, the Committee had now prepared a scheme based upon the use both of that method and the overhead-trolley system on the existing tramways on the north of the Thames, and on certain new lines which have already been authorised. The length of conduit line proposed was about 26 miles, and included all the tramway routes in the more central districts, while that of the projected overhead-trolley system was about 28 miles. As the consent of the road authorities concerned was needed to allow of the introduction of the overhead system, the Committee proposed to seek such permission before taking further steps for the preparation of specifications and estimates in respect of the contemplated trolley lines. The company's lease contains a provision giving the County Council the option of reconstructing the tramways, or of requiring the company to do so. It was, however, thought advisable in view of the Council's ownership of the lines, and the comparatively short period which the lease has to run, that the Council itself should carry out the work. The Committee submitted a list of the lines proposed to be converted to the one or the other system, and asked for authority to prepare the plans for the works and to seek the consent of the Borough Councils concerned by the proposed trolley lines.

Testing Stations.—The report of the Highways Committee further pointed out that Section 37 of the Kensington and Knightsbridge Electric Lighting Order, 1899, provides that "the undertakers shall . . . . at such places within a reasonable distance from a distributing main, establish at their own cost, and keep in proper condition, such reasonable number of testing stations as the County Council shall deem sufficient for testing the supply of energy by the undertakers through such main, and shall place thereat proper and suitable instruments of a pattern to be approved by the Board of Trade, and shall connect such stations by means of proper and sufficient electric lines with such mains and supply energy thereto for the purpose of testing." Under Section 38 and other following sections, the undertakers are required to keep upon their premises suitable and proper instruments of such pattern and construction as may be from time to time approved or prescribed by the Board of Trade, to keep such instruments in efficient working order, and also to give facilities of access to inspectors appointed by the County Council, for the purpose of testing; and the inspectors' remuneration and expenses are to be paid by the undertakers. The Highways Committee observed that similar provisions were contained in other orders, but the Council had not yet been in a position to call upon any of the undertakers to fulfil their obligations as regards the establishment of testing stations, as no instruments had been approved by the Board of Trade as being suitable. As, however, the Board had recently intimated its intention of approving testing instruments which are to be obtained in the market, the Committee thought that the time had arrived for the Council to take the necessary action in regard to the matter. They therefore proposed that a beginning should be made with the Kensington and Knightsbridge Co., which, the Committee were informed, was prepared to make arrangements for the establishment of testing stations when required to do so.

Personal.—Owing to the decease of Mr. George Anderson a vacancy occurred last month in the representation of the Candlewick Ward in the Court of Common Council. Four candidates were nominated for the position, and Mr. Ernest H. Lamb, of 37, King William Street, E.C., the managing director of the New System Private Telephone Co., headed the poll when the result was declared on the 15th inst. The new Councillor is also a director of the Yorkshire Private Telephone Co., Ltd.

Mr. H. Bell, Cardiff district manager for the National Telephone Co., has been promoted to a position in London.

Royal Society.—Among the papers down for reading yesterday afternoon were the following:—

"Sur la Diffraction des Ondes Electriques à propose d'un Article de Macdonald," by Prof. H. Poincaré, For. Mem. R.S.

"An Analysis of the Results from the Kew Magnetographs on *Quiet* Days during the Eleven Years 1890 to 1900, with a Discussion of Certain Phenomena in the Absolute Observations," by Dr. C. Chree, F.R.S.

The Faraday Society.—We have received a copy of the rules that have been drawn up by the council of the newly-formed society of electro-chemists, to be recommended for acceptance by the general body of members. The name adopted is "The Faraday Society," and its objects are to promote the study of electro-chemistry, electro-metallurgy, chemical physics, metallography, and kindred subjects. In order that the work of the society should proceed without delay, it has been decided to begin a half-session on July 1st, and with that object in view the first ordinary meeting will be held on June 30th. The subjects of the papers to be read on the occasion will be duly announced. All further particulars can be obtained on application to Mr. F. S. Spiers, the hon. sec., 82, Victoria Street, S.W.

Automobile Track.—An automobile track, to give a circuit of seven miles, is to be constructed at Purley for the Automobile Club, for trials and race meetings.

The "Technolexicon."—Dr. Hubert Jansen, the editor-in-chief of the "Technolexicon" of the Society of German Engineers, sends us a report showing how far the work has proceeded It appears that there are now 341 societies, (42 in English, 272 in German, and 27 in French speaking countries) co-operating in the work, either by the systematical collection of technical expressions of the specialities represented by them or in any other ways, especially by the acquisition of collaborators and by placing technical publications in more than one language at the disposal of the "Verein," as catalogues of firms, inventories, price lists of machines, handbooks, &c. Through these societies the "Technolexicon" has found helpers in Great Britain, Germany, France, the United States, Austria, South Africa, India, Australia, Belgium, Canada, &c. Assistance has so far been promised—and partly already rendered—by 2,185 industrial establishments and individual collaborators. For convenience's sake the Society of German Engineers has provided handy note books (each with three indices A—Z) for collaborators to write their collections therein. These books will be called in by the editor-in-chief in the course of 1904. 207 filled note-books have already been forwarded voluntarily to the office. As the contributions will not be called in before 1904, all who wish to help in the compilation of the "Technolexicon" have still time and opportunity to assist in the preparation of their specialities. Contributions from all technical branches (including the handicrafts) will be welcomed. Delayed contributions, if they arrive before the end of 1906, can still be made use of. Letters should be addressed, "Technolexicon," Dr. Hubert Jansen, Berlin (N.W. 7), Dorotheenstr. 49.

Municipal Loans.—The Industrial Freedom League has sent an influentially-signed memorial on the subject of municipal loans to the Governor and company of the Bank of England. In reply thereto the Governor stated that the Court of Directors was "fully alive to the importance of the matter." The memorial reads as follows:—

"We, the undersigned, desire to draw the attention of the Governors of the Bank of England to the policy of commercial adventure upon which many local authorities are now embarking, and which, if continued, will greatly increase the amount, and seriously affect the character of municipal stocks.

"Trading enterprises of various kinds are now being undertaken by municipalities, many of them embracing inventions of no doubt a highly interesting and useful character, but which are continually being improved, and are, therefore, unsuited for the investment of municipal funds, especially having regard to the fact that the municipal stocks of the larger cities are authorised trustee investments.

"The most recent returns show that the debt of local authorities of England and Wales amounts to £:00,000,000, while the capital amount of their strictly trading concerns (exclusive of water) has doubled itself in the last two years.

"Your memorialists feel that there are other strong reasons that might be urged, as, for instance, the check to private enterprise. Again, the fact that such enterprises require the closest attention, if heavy loss is to be avoided, must prevent municipalities from being able to give sufficient time and thought to the important duties which fall within the scope of their proper functions. Your memorialists do not, however, urge these or other reasons on the present occasion, as, though important, they are not of a financial character.

"Your memorialists respectfully submit that proposals of the municipalities for further loans for trading purposes or of municipalities which have charged their rates to any serious extent for such somewhat speculative purposes, should be discouraged, and that all loans to municipalities should be kept within prudent limits."

Wolverhampton Tramways: An American View.—The last issue of the *Street Railway Journal* contains the following comments upon the surface contact tramway situation at Wolverhampton:—"Altogether, the report does not sound very encouraging, and it fully bears out the American practice of keeping clear of such systems and going to conduit roads wherever the overhead trolley wire is barred out. A well-installed overhead trolley system, with feeders and all cables for other classes of electric service underground, probably represents the cheapest and most reliable phase of electric railway service. Of course, a certain amount of danger inheres in the overhead wire at 500 volts or more, but it has been conclusively shown by experience that nearly all the practical danger comes from the breaking of other wires than the trolley wire. The records of the surface contact roads in Paris have been distinctly unfavourable, as shocks from studs left alive after the cars have passed have been extremely common, and have killed a number of horses. Those in Wolverhampton are said to have been 'harmless,' but we very much doubt whether the American public would enjoy the greater chance of these 'harmless shocks,' which Mr. Shawfield attributes to the surface contact system. The results in cities where there is no great street traffic, as Tours and Monte Carlo, have been much more satisfactory than where there is a large street and car traffic, as in Paris. For this reason there was some hope that the Wolverhampton system would be somewhat more successful than it has proved to be. It is a pretty good rule to follow to keep conductors out of reach of man and beast, even when charged at only a low voltage."

The Junior Engineers.—The summer excursion of the Junior Institution of Engineers is to be held at Sheffield this year from August 15th to 22nd. Amongst the works to be visited are Messrs. Hadfield's Hecla steel foundries.

The Electrical Volunteers.—On Monday evening last at the Headquarters, Regency Street, Westminster, the distribution of the South African War medals to the Electrical Engineers R.E. (Volunteers) took place. The presentation was made by Major-General W. T. Shone, C.B., D.S.O.

Appointments Vacant.—An accountant clerk is required for the Reading Corporation tramways department (£100); the Preston Union wants a working mechanical electrical engineer; a shift engineer is required for the Paisley electricity works. See "Official Notices" to-day.

THE CENTRAL STATION ENGINEER.

The second annual "smoker" in connection with the Manchester Corporation Electricity Department was held in the large hall at the Albion Hotel on Friday, May 15th. The chief engineer, Mr. Metzger, presided over an enthusiastic gathering of about 350, which included several representatives of the contractors, in addition to the members, and a large number of employés of every branch of the department. A long musical programme had been arranged, which was highly successful.

The second annual staff dinner was held at the Grand Hotel on Wednesday, May 20th. Mr. Metzger, the chief engineer, again presided, over a gathering of about 40. Amongst the visitors present were Mr. J. M. McElroy, the general manager of the tramways department, and Mr. Gunton, representative of Dr. Kennedy. After the toast of "The King," Councillor Bowes, one of the oldest members of the Committee, proposed "The Staff" in a humorous speech. In the course of his reply, Mr. Metzger gave some interesting figures relative to the size and output of the department. Already the largest municipal undertaking, it was second only to the City of London Co in maximum demand last winter, and this year intends to head the list. Mr. Metzger also, to some extent, forecasted the future of the department financially and otherwise, and his remarks on this point would, no doubt, be gratifying to the members of the Committee present. Mr Pearce, the deputy chief engineer, in a well chosen speech, proposed "The Visitors," to which Mr. McElroy responded. The latter complimented the Manchester Corporation Electricity Department on the splendid work done for the tramways department, and in connection with this, the name of Mr. Gunton was received with well merited applause. The last toast, that of "The Chairman," was briefly proposed by Councillor Allison, and rendered with musical honours, after which Mr. Metzger replied. The dinner was also made the occasion on which to make a presentation to Mr. Kemp, the resident engineer at Stuart Street station, who is leaving the department to take up an important position on Dr. Kennedy's staff A highly enjoyable evening was spent, and a capital musical programme had been arranged to which nearly every member of the staff contributed, from the chief engineer downwards. Mr. Pearce efficiently presided at the piano, and the evening closed with "Auld Lang Syne."

Mr H. H. Blakey, of the Corporation Electricity Works, Lancaster, has this week been appointed resident electrical engineer at the East Sussex County Asylum, Hellingley.

Barrow T.C on Monday decided to increase the salary of the resident electrical engineer from £300 to £400 per annum.

On Saturday last, the 23rd inst., the staff of the Corporation of Croydon had a 20-mile walk, in which 28 took part. This was won by a member of the electricity works' staff, Mr. H. D. Morrant, who did the course in 3 hrs. 36 mins., which, considering the short time for training (about a fortnight), and the difficulty of the course, was very good indeed. The competitors were started by the Mayor of Croydon, and Mr. J. Gray Scott, the borough electrical engineer, and several of the heads of departments, acted as judges.

Mr. J. P. Kemp, resident engineer at the Manchester Corporation Electricity Works (Stuart Street), has left Manchester to take up an appointment under Dr. Kennedy, in whose intersts he is at present watching the Mersey Tunnel scheme. Mr. A. E. McKenzie has been appointed resident engineer in Mr. Kemp's stead.

NEW COMPANY REGISTERED.

Mono-Rail Construction Co., Ltd. (77,484).—This company was registered on May 23rd, with a capital of £10,000 in £10 shares (3,000 "A" ordinary, 1,000 "B" ordinary, and 2,000 preference), to undertake the issue of the capital of any company whatsoever, and in particular that of the Manchester and Liverpool Electric Express Railway Co., to enter into an agreement dated April 28th, 1903, between the Manchester and Liverpool Electric Railway Syndicate, Ltd., of the one part, and D. Williams (for this company) of the other part, to undertake or aid any enterprise and carry out any transaction or operations which may be lawfully carried on by capitalists, to carry on a general financial business in any part of the world, to form and carry on or take part in syndicates in connection with the business of this or any other company or in connection with any shares, stocks, debentures, securities, properties, schemes

or undertakings, to lend money on any security, to promote companies in Great Britain or elsewhere, to obtain contracts for and carry out the construction, equipment, maintenance and working of light, electrical and other railways, or tramways and motors therefor, to apply for Parliamentary, county, municipal and other powers, whether British, Colonial or foreign, to acquire any existing railways or tramways, to manufacture and deal in vehicles, whether propelled or drawn by mechanical or animal power, to generate and supply electricity for light, heat, motive power or other purposes, to carry on business as india-rubber and tire manufacturers, &c. The signatories are:—

	Shares.
Helbert, Wagg & Russell, South Sea House, Threadneedle Street, E.C., stockbrokers	1,000
C. Lichtenstadt, 33, Throgmorton Street, E.C., stockbroker	1,000
L. Neumann, 11, Grosvenor Square, W., stockbroker	550
A. Friedlander, 11, Throgmorton Avenue, E.C.	550
D. Carke, 31, Threadneedle Street, E.C., stockbroker	100
E. H. Byas, 11, Cambridge Gate, Regent's Park, N.W., gentleman	50
W. I. Higham, Warnford Court, E.C., stock and share dealer	100
A. L. Schill & Co., Warnford Court, E.C., stockbrokers	100
Hamham & Co., Stock Exchange, E.C., stockbrokers	100
H. S. Middleton, Stock Exchange, E.C., stock and share dealer	50
C. Henry, 12, Leadenhall Street, E.C., gentleman	50
J. G. Verger & Co., 5, Copthall Court, E.C., stockbrokers	50
J. Pollock, Stock Exchange, E.C., stockbroker	50
Ansell, Mankiewig & Tallisman, Warnford Court, E.C., stockbrokers	200
Horn & Pitman, 14, Austin Friars, E.C., stockbrokers	25
A. Tedeschi, 22, Austin Friars, E.C., stockbroker	50
A. Haes, 1, Drapers' Gardens, E.C., gentleman	50
Williams de Broë & Co., 6, Tokenhouse Yard, E.C., stockbrokers	50
Bourke, Cuthbert & Co., 6, Throgmorton Street, E.C., stockbrokers	50
T. L. M. Llewellyn, 24, Austin Friars, E.C., gentleman	50
Kennedy & Robinson, Bartholomew House, E.C., stock dealers	50
W. M. Chinnery, Bartholomew House, E.C., stock dealer	50
J. J. Jones, 51—2, Fenchurch Street, E.C., merchant	20
E. Crewdon, 7, Norfolk Street, Manchester, chartered accountant	100
H. L. Russell, South Sea House, Threadneedle Street, E.C.	125
Miset, Pering, Smith & Co., 7, St. Helens Place, E.C., solicitors	25
Crews, Lichtenstadt & Co., 33, Throgmorton Avenue, E.C., stockbrokers	125
Helbert, Wagg & Co., South Sea House, E.C., stockbrokers	50

No initial public issue. The number of directors is not to be less than two nor more than three; the first are M. Drummond and A. E. Crews; qualification, 10 preference shares; remuneration, £300 per annum, divisible.

ELECTRICITY SUPPLY ACCOUNTS.

Middlesbrough Municipal Electric Supply.

As we might safely have predicted, the returns of the Middlesbrough Electrical Department for the year just ended, are of a satisfactory character.

The department started to supply consumers in December, 1900, and the second complete year's work shows an increased output of 57 per cent., together with a satisfactory decrease in works costs.

The reduction in price, during the past year, although resulting in an average price per unit, below that of the majority of towns of similar output, is certainly justified in a thriving industrial centre like Middlesbrough in which the power load, as yet undeveloped, should be considerable. Mr. H. B. Taylor is the chief engineer.

General Statement.

For year ending March 31st—		1902.	1903.	Inc.
Total capital expended		£54,152	£68,640	£14,488
Number of units sold		284,332	446,386	162,054
Equivalent number of 8-c.p. lamps connected		18,647	33,335	14,688
Maximum load in kilowatts		445	595	150
Revenue Account. Gross revenue		£4,761	£6,712	£1,951
" expenditure		£2,660	£3,410	£750
" profit		£2,101	£3,302	£1,201
Average price per unit sold		3·95d.	3·53d.	—·42d.

The small increase in maximum load is attributed to the fact that 6,000 lights have been connected since December last. The total H.P. of motors connected amounts to 122.

The prices charged are: for private lighting, 6d. and 2d.; and for power, 2d. and 1d.; discounts of 5 per cent. being allowed for payments within one month.

Revenue Statement.

	1902. Gross.	1902. Per unit.	1903. Gross.	1903. Per unit.	Inc.
Sale of energy	£4,668	3·95d.	£6,553	3·53d.	—·42d.
Meter rents, &c.	93	·07d.	159	·08d.	·01d.
Gross revenue	£4,761	4·02d.	£6,712	3·61d.	—·41d.

Working Expenses.

For year ending March 31st—	1902. Gross.	1902. Per unit.	1903. Gross.	1903. Per unit.	Inc.
Coal and cartage	£713	·60d.	£1,141	·61d.	+·01d.
Oil, waste, water and engine-room stores	249	·21d.	174	·09d.	—·12d.
Wages of workmen	486	·41d.	649	·35d.	—·06d.
Repairs and maintenance of engines, boilers, mains, &c.	165	·14d.	293	·16d.	+·02d.
Works costs	£1,613	1·36d.	£2,257	1·21d.	—·15d.
Rents, rates and taxes	447	·38d.	557	·30d.	—·08d.
Salaries of electrical engineer, assistants and clerical staff	444	·38d.	492	·26d.	—·12d.
Management expenses including printing, stationery, law, insurance and sundries.	156	·13d.	164	·06d.	—·07d.
Total costs	£2,660	2·25d.	£3,410	1·83d.	—·42d.

Profit Statement.

	1902.	1903.
Interest and sinking fund	£2,763	£3,729
Balance	—662	—463
Gross profit	£2,101	£3,266

With a gross profit of £3,266, the department had to meet financial charges of £3,729, resulting in a deficiency of £463 on the year's working. It is, however, only fair to mention that had no reduction in price been made, the profit on the year's working would have more than sufficed to meet the financial charges.

ELECTRIC TRAMWAY ACCOUNTS.

Huddersfield Corporation Tramways.

We give herewith a comparison of the returns of the Huddersfield tramway undertaking for the past two years' working.

The accounts for the steam section are identical with those of the previous year, but in the electrical section there has been a large increase in the number of passengers carried, with a small decrease in receipts per car-mile, but accompanied, unfortunately, by an abnormal increase in working expenses, with a resulting deficiency for the year of £11,568.

The decreased receipts per car-mile are probably the outcome of extended mileage, and are barely 1d. per car-mile less than the average of a dozen of the largest municipal tramways, so that no great improvement in that direction can be looked for. Working expenses have moved upwards largely through a compensation item, due to the Almondbury accident; last year's figure, 5·36d., having increased to 6·09d. per car-mile, the bill for compensation accounting for ·64d. of this amount. The increased figure is, however, still 1d. per car-mile less than the average dozen municipal tramways, and its proportion of the total cost is small compared with financial charges, which have contributed largely to the year's deficiency. Mr. H. W. Thomas is the engineer and manager.

General Particulars.

Returns for year ending March 31st.	1902.		1903.	
Length of route	28·5 miles.		28·5 miles.	
" " track	35 miles.		38 miles.	
Average number of cars in use	—		60	
Electrical energy used	—		2,068,690 units.	
Capital expenditure to date	£384,794		£400,000	
	Steam.	Electrical	Steam.	Electrical
Car-miles run	47,817	92,394	47,817	1,374,112
Passengers carried	Estimated.	7,841,432	408,771	9,329,442
Traffic receipts	£2,555	£40,894	£2,555	£54,077
Working expenses	£1,411	£21,595	£1,411	£23,320
Gross profits	£144	£18,797	£144	£30,757
Income per car-mile	12·83d.	10·51d.	12·83d.	10·18d.
Working expenses per car-mile	12·10d.	5·61d.	12·10d.	6·29d.
Interest, sinking fund and depreciation per car-mile	3·57d.	5·36d.	3·57d.	6·09d.
Total expenses "	15·67d.	10·97d.	15·67d.	14·37d.
Profit or loss "	—2·85d.	—·46d.	—2·85d.	—2·19d.
Cost of electrical energy per car-mile		·45d.		·45d.
Average fare per passenger		1·3d.		1·4d.
Average fare charged per mile		·8d.		1d.
Revenue per mile of route	£1,534		£2,022	
Expenditure " "	£1,618		£2,456	

Analysis of Working Expenses.

For year ending March 31st—	1902. Gross.	1902. Per unit.	1903. Gross.	1903. Per unit.
Generation of electricity	£1,731	·45d.	£3,404	·45d.
Traffic expenses, including wages, motormen, conductors, oil, sand, &c.	10,345	2·69d.	14,145	2·66d.
Printing, stationery, uniforms, and compensations	1,733	·45d.	5,818	1·10d.
Salaries	1,017	·26d.	1,579	·30d.
Rent, rates, taxes and insurance	1,483	·37d.	1,800	·34d.
Repairs and Maintenance—				
Rolling-stock	3,509	·91d.	5,431	1·02d.
Permanent way	913	·24d.	1,207	·2 d.
Electrical equipment	634	·17d.	731	·14d.
Buildings	276	·07d.	413	·8d.
Total working expenses	£21,594	5.61d.	£33,320	6·28d.

The gross profit on the year's working of the electrical section amounted to £20,757, as compared with £18,797 in the previous year. As interest and sinking fund absorbed £24,090 and a sum of £8,235 was contributed to the depreciation account, a deficiency of £11,568 was caused, which with the deficiency on the steam section amounts in the total to £12,136 for the year.

Taking into account the somewhat uncertain life of tramways, the department is taking up a safe though trying position on the depreciation question.

PROFIT STATEMENT.

—	1902. Steam.	1902. Electric.	1903. Steam.	1903. Electric.
Interest and sinking fund..	£527	£14,307	£527	£24,090
Depreciation	184	6,295	184	8,235
Balance, profit or loss ..	—567	—1,805	—567	—11,568
Gross profit	£144	£18,797	£144	£20,757

CITY NOTES.

Official Announcement re Companies.

THE following are to be struck off the register unless cause is shown to the contrary within three months:—

British Volta Electric Glow Lamp Co.

Collier-Marr Telephone and Electrical Manufacturing Co.

Electric Arms and Ammunition Syndicate.

General Traction Co.

International Electric Storage.

Lithanode Electric Storage Co.

Merthyr Tramway Co.

Monte-Video Tramways Co.

Universal Electric Lighting Co.

Western Telegraph Co. (1889).

Woking Sanitary Electric Laundry Co.

Castner-Kellner Alkali Co.

THE annual meeting of this company was held at Cannon Street Hotel on 20th inst.

Sir WILLIAM MATHER, M.P., who presided, said that they were pleased to be able to present a report of such a healthy character, considering the condition of the alkali trade during the last year. Though one of the company's main products stood at an extremely low price during a great portion of the year, the total outcome of the business had been satisfactory. They now saw before them important developments and improvements in regard to their process of manufacture, which pointed to important economies; so that even if bleaching powder remained at the present price they would go a long way to recover their profit on the article. They had continually endeavoured to develop improvements in every direction, and had, therefore, considered it right to utilise the reserve depreciation fund as capital, in order to put down plant of a character in accordance with the scientific development of the times, thereby cheapening and improving the products of the company. He had every reason to believe that the expenditure of this reserve capital on the company's works would enable them to realise in the near future—certainly within two or three years—something over 30 per cent. on the investment, while the result would point to a possible increase in the company's income, tantamount to about 5 per cent. upon the whole of the subscribed ordinary capital. They, therefore, considered this policy one to be adopted in the interests of the shareholders, as they desired to strengthen the business. The company were not confined to the manufacture of caustic soda and bleach, but were seeking fresh fields. He, therefore, recommended that they should not pause in putting down increased plant or altering existing plant, so as to derive from their manufactures in future a satisfactory profit. They were continually trying experiments in the treatment of many substances which hitherto had not been treated electrolytically.

Mr. FRANK HARDCASTLE seconded the resolution, which was agreed to.

Stock Exchange Notice.—The Committee has appointed a special settling day as under:—Thursday, June 4th, British Columbia Electric Railway Co., Ltd.—6,000 5 per cent. cumulative perpetual preference shares of £10 each, fully paid, Nos. 45,001 to 51,000, and has ordered same to be quoted in the Official List.

STOCKS AND SHARES.

Wednesday Evening.

THE Whitsuntide holidays form a convenient peg upon which to hang excuses for the general slackness of business in the Stock Exchange; but the candid commentator upon the markets is compelled to wonder whether trade would be any better were there no recess. In nearly every department of the House the same tale of hope deferred makes sick the hearts of shareholders; and with the summer so close at hand, it is difficult to see how any real revival of activity can be anticipated for the present. Twelve months ago, when the country stood upon the edge of peace, markets went ahead in all directions, upon the hope that once the olive-branch had beaten down the upturned swords, there would come a great stirring of the stagnant waters of the Stock Exchange. But how illusory that anticipation has proved most investors have cause to know only too well.

Money remains expensive, despite the lowered Bank Rate, but the few changes in our lists are fairly well divided over rise and fall. The most dramatic event of the week consists of a rise of some seven points in National Telephone Deferred stock, the other issues of the company remaining almost stationary.

Early next month will see two interesting emissions in the electrical supply section. The Edmundson Co. will probably offer its shareholders both new Ordinary and new Preference shares, and although details have still to be arranged, no doubt the prices of issue will be very acceptable to those who have the right to subscribe. The new Charing Cross City undertaking Preference shares, to which reference has already been made on a former occasion, will probably be out next week, and the preliminary prospectus is in course of circulation. While no market has yet been made in the new Metropolitan shares, it may be fairly near the mark to suppose that the quotation will start at about $\frac{1}{16}$ to $\frac{3}{16}$ premium.

Metropolitan Ordinary shares are ¼ up, after going easier, the market being narrow and a small seller having appeared in the land. City of London Ordinary have declined a ¼, although it is not thought that the accident in the City on Monday last will affect the company to any extent. Westminster Preference are also ¼ easier, and so are South Londons, the erratic working of the new electric tramway service having an indirect influence on the price of the shares. Charing Cross Debenture stock has recovered a brace of points, but otherwise the gilt-edged list shows no variation. Steady buying of Urban Electric shares continues, and this week the price of the Ordinary has followed that of the Preference in advancing to a shade over par.

Cromptons fell to 2¼ upon a selling order from the country, but this decline in the Industrial list is balanced by a 10s. rise in India-Rubber shares, the price of which has hardened to 19½. British Westinghouse Preference slipped back to 6 sellers, but quickly recovered to 6½; the Ordinary shares are about 7, and London United Ordinary are 21½, the Preference keeping at 11¾.

National Telephone Deferred stock, which stood at 75 a couple of months ago, is now 90, and the rumour runs that the company will declare a 6 per cent. dividend on Deferred and Preferred alike. The declaration can hardly be made until August, so the market must not be accused of backwardness in framing its estimates. On the Deferred stock 4½ per cent. was paid during the last two half-years. Shortage of stock, no doubt, has something to do with the rapid rise; but as there is about two millions sterling of this security afloat, it will be surprising if the jump does not attract sellers. The Preferred stock is a point to the good, and is either greatly undervalued, or else the Deferred is too highly priced. Oriental Telephone shares are $\frac{1}{16}$ off, and Cubas exhibit no alteration.

Influential financiers are behind the Mono-Rail scheme for the north, particulars of which have been appearing in the papers during the last few days, and we may supplement the information of our contemporaries with the news that a much larger concern is being prepared to take over the present small syndicate, in which former the public will be invited to take a hand. Beyond this there is no item of special interest to record as regards the electrical railway market. None of the purely electrical stocks have moved, but Districts drooped to under 40, and Metropolitan Consolidated at 90 is also lower.

In the telegraph section the sensational drop displayed by the American railroad market finds a faint reflection in a small Anglo "A" decline. The Ordinary and Preferred stocks are motionless, and none of the other United States stocks have been affected. Eastern Extensions keep dull, shedding another 10s this week, and the cheerful tone of the Marquis of Tweeddale's speech at last week's Globe Telegraph meeting has failed to inspire any better tendency into this section. Eastern Ordinary and Submarine Cables are both the better. The leading financial weekly has an interesting article on the subject of the best telegraph companies, and following a recital of the various reserve funds that these undertakings have built up, the conclusion is drawn that, at all events, the financial position in most cases should help to reassure proprietors who are frightened by the Marconi bogey. By the way, the happily contradicted reports of Signor Marconi's indisposition had no effect upon the price of the shares identified with his name.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations May 20th.	Closing Quotations May 27th.	Business done week ended May 27th, 1903. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	97 —101	98 —102	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2⅛— 3⅛	2⅛— 3⅛	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 — 80	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	3⅛%	61s.	60/6	47 — 50	47 — 50	..	..
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	89 — 91	89 — 91	90½	89
3,105,580	Do. do. do. Deferred	Stock	5s. 6d.	2s.	1/-	8½— 8⅝	8 — 8⅛	8 1/16	..
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	..	4⅜— 5⅛	4⅜— 5⅛	..	..
13,333,300$	Commercial Cable	$100	8 %	8 %	..	155 —165	155 —165	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	89 — 92	89 — 92	90	89
16,000	Cuba Telegraph	10	4½%	4 %	6¾%	6½— 7⅛	6½— 7⅛	6⅞	6½
6,000	Do. 10 % Pref.	10	..	..	..	14 — 15	14 — 15	..	..
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	2½— 3⅛	2½— 3⅛	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
30,000	Do. do. 4½ % Debs.	50	..	..	..	98 —102	.. — ..	..	..
60,710£	Direct United States Cable	20	3½%	3½%	..	9 — 10	9 — 10	9½	9
92,800£	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,800, Red.	100	..	..	..	99 —102	99 —102	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	..	117 —122	117 —122	120½	119½
1,955,565	Do. 3½ % Pref. Stock	100	..	..	..	82 — 85	83 — 86	83	82
1,534,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	104 —107	104 —107	106½	105½
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	11 — 12	10½— 11½	11	10½
880,000£	Do. 4 % Deb. Stock	Stock	..	..	..	105 —108	105 —108	..	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 3,000, red. 1909	100	..	..	..	99 —102	99 —102	..	..
300,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	101 —104 %	99 —102	100½	..
180,227	Globe Telegraph and Trust	10	5½%	5½%	..	8⅝— 9	8⅝— 9	8⅝	8½
180,042	Do. do. 6 % Pref.	10	..	..	..	11⅜— 12⅜	11⅜— 12⅜	12 1/16	12
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	15 %	12½%	22 — 24	22 — 24	..	..
66,800£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	99 —102	99 —102	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	10%	36 — 40	36 — 40	39	..
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	..	..	..	101 —104	100 —104	..	..
1,983,333	National Telephone, Pref. Stock	100	5 %	5 %	6 %	101 —103	102 —104	103⅞	101⅞
1,966,667	Do. do. Def. Stock	100	..	..	4½%	81 — 83	88 — 90	89½	82½
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	13 — 14	13 — 14	13⅞	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 13	12 — 13	12⅞	..
250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5⅜	5⅛
2,000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	97 — 99	98 —100	99	98½
600,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	102 —104	102 —104	103½	103
171,504	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	6 %	7/16— 1	1⅛— 1⅛	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	97	..
11,889	Reuter's	8	5 %	5 %	..	6½— 7⅛	6½— 7⅛	..	..
8,808	Submarine Cables Trust	Cert.	..	..	..	102 —112 xd	103 —111	..	..
58,000	United River Plate Telephone	5	7 %	7 %	..	5⅛— 6	5⅛— 6	5⅛	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4⅛— 5⅛	4⅛— 5⅛	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	105 —108	105 —108	..	..
15,609	West African Telegraph, Shares	10	..	..	..	3 — 4	3 — 4	..	..
30,008	West Coast of America, Nos. 1 to 30,000 and 53,001 to 53,008	2½	..	..	..	0 — ¼	0 — ¼	..	..
150,000£	Do. do. 4% Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	..	..	..	92 — 97	92 — 97	..	..
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	..	11 — 12	11 — 12	11⅛	11
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	101 —104	101 —104	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	96 — 99	96 — 99	96⅜	..
88,321	West India and Panama Telegraph	10	1%	..	..	¼— ⅜	¼— ⅜	..	..
84,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	6½— 7	6½— 7	..	..
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	3¾— 4¼	3¾— 4¼	4	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	99 —102	99 —102	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	..	..	..	3 — 4	3 — 4	..	..
800,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	73 — 78	73 — 78	..	..
100,000	British Electric Traction	10	9 %	9 %	..	14 — 14½	14 — 14½	14 5/16	14¼
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	12 — 12½	12 — 12½	12 5/16	12 5/16
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	122 —125	122 —125	124½	..
100,000	British Insulated and Helsby Cables	5	15 %	10 %	10 %	6⅞— 7⅛	6⅞— 7⅛	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5⅞— 6	5⅞— 6	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	102 —106	102 —106	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	8 %	Nil	..	3/16— 1/4	3/16— 1/4	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	6 %	..	15/6 to 16/6	15/6 to 16/6	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	5 %	Nil	Nil	1⅜— 1½	1⅜— 1½	1⅜	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	3 %	6 %	1½— 1⅝	1½— 1⅝	1 5/16	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	99 —102	99 —102	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	89 — 94	89 — 94	..	..
35,000	Callender's Cable Construction shares	5	15 %	20 %	15 %	13 — 14	13 — 14	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5⅞— 6	5⅞— 6	..	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	108 —112	108 —112	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	..	4 %	4 %	106 —109	106 —109	108	107
494,093	Do. do. 4 % Pref. Stock	Stock	..	4 %	4 %	103 —106	103 —106	..	..
494,998	Do. do. Def. do.	Stock	..	4 %	4 %	108 —111	108 —111	110	..
1,330,000	City and South London Railway	Stock	1½%	2 %	3½%	71 — 73	71 — 73	72	71
85,000	Crompton & Co., Nos. 1 to 85,000	3	8 %	7½%	..	2½— 2⅝	2 — 2½	..	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	102 —106	102 —106	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	2½%	Nil	..	0 — ¼	0 — ¼	..	..
17,139	Do. do. "A" shares, 01—017,139	5	2½%	Nil	..	1⅛— 2⅛	1⅛— 2⅛	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	73 — 77	73 — 77	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	75 — 80	75 — 80	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	..	1⅝— 2	1⅝— 2	..	..
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390	2	..	..	..	2⅛— 3	2⅛— 3	..	..
82,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	100 —103	100 —103	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	9½— 10⅛	10 — 10⅛	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	99 —102	99 —102	..	..
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	20 %	15 — 16	15 — 16	16½	..
35,000	Do. do. 4½ % Pref.	5	4½%	..	..	5 — 5⅛	5 — 5⅛	..	..
48,050	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	107 —111	107 —111	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	18¾— 19¾	19 — 20	19½	19⅜
800,000£	Do. do. 4 % 1st Mort. Deb.	100	..	..	..	100 —103	100 —103	..	..
87,500	†Liverpool Overhead Railway, Ord.	10	3⅛%	1¼%	1¼%	5⅛— 15/16	5⅛— 6	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	10⅜— 11	10⅜— 11	..	..
37,350	Telegraph Construction and Maintenance	12	17½%	20 %	20 %	33 — 36	33 — 36	34	..
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 —104	101 —104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3 %	3⅛%	99 —102	99 —102	..	..

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ From Manchester Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1/-—2/-.
National Electric Free Wiring, 14/- —16/-.
Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—14¾.
Do. do. Pref. (£10 pd.), 10—10½.

Bank rate of discount 3½ per cent. (May 21st, 1903).

SHARE LIST OF ELECTRICAL COMPANIES (continued).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years.			Closing Quotations May 20th.	Closing Quotations May 27th.	Business done week ended May 27th, 1903.	
		‡	1900.	1901.	1902.			Highest.	Lowest.
100,000	Blackheath and Greenwich Dist. Electric Light, Ord.	1	..	..	..	⅜ — ⅝	⅜ — ⅝	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs.	100	..	..	..	118 —121	118 —121	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000	5	6 %	8 %	8 %	10¼ — 11	10¼ — 11	..	..
20,000	Do. do. 7 % Cum. Pref.	5	..	..	..	10½ — 10⅝	10½ — 10⅝	..	..
50,000	Charing Cross and Strand Electricity Supply	5	9 %	10 %	10 %	9 — 9⅛	9 — 9⅛	9 7/16	9⅛
70,000	Do. do. do. 4½% Cum. Pref.	5	..	..	..	5⅛ — 6	5⅛ — 6	..	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref.	5	..	..	..	4½ — 5⅛	4½ — 5⅛	..	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	105 —107	106 —108	..	..
44,436	*Chelsea Electricity Supply, Ord.	5	5½%	4 %	4½%	6 — 6⅛	6 — 6¼	6¼	..
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	109 —112	109 —112	109	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595	10	0 %	5 %	5 %	11½ — 12	11⅝ — 11¾	11⅞	11 7/16
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	..	..	13 — 14	13 — 14	13⅜	13⅛
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	123 —128	123 —128	..	..
300,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	103 —106	103 —106	..	..
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4 %	8 — 9	8 — 9	..	..
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	..	..	..	12 — 13	12 — 13	..	..
400,000‡	Do. do. 4½% Deb. Stock, Prov. Certs. (all paid) Red	..	..	..	..	111 —114	110 —113	..	..
50,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	..	6⅞ — 7⅛	6⅞ — 7⅛	6 15/16	..
80,000	Do. do. 6 % Cum. Pref.	..	..	..	..	6 — 6⅛	6 — 6⅛	..	..
140,000	Do. do. 4½% 1st Mort. Deb. Stock	100	..	..	..	107 —110	107 —110	..	..
21,000	Kensington and Knightsbridge Electric, Ord.	5	12 %	10 %	10 %	11 — 12	11 — 12	..	..
90,000	Do. do. do. 4 % Debenture Stock	Stock	..	..	..	103 —106	100 —103	..	..
110,000	London Electric Supply Corporation, Limited, Ord.	3	..	..	..	2⅛ — 2⅜	2⅛ — 2⅜	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	5⅛ — 6	5⅛ — 6	..	..
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	100 —103	100 —103	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6 %	6½%	7½%	17 — 18	17½ — 18⅜	18⅛	17 11/16
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	110 —115	110 —115	..	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	98 —101	98 —101	20½	..
10,852	Notting Hill Electric Lighting	10	7 %	6 %	6 %	14 — 15	14 — 15	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	15½ — 16½	15½ — 16½	..	..
20,000	Do. do. do. 7 % Pref. 20,001 to 40,000	5	..	..	..	8½ — 9½	8½ — 9½	..	..
150,000‡	Do. do. do. 3½% Deb. Stock Red	100	..	..	..	99 —102	99 —101	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	..	2½%	3 — 3⅛	3 — 3⅛	..	..
50,000‡	Do. do. 4% Deb.	100	..	..	..	88 — 93	88 — 93	..	..
65,000	South London Electricity Supply, Ord.	5	..	..	1½%	3½ — 4	3½ — 3⅝	..	..
30,000	Urban Electric Supply, Ord.	5	..	..	..	4½ — 5⅛	5 — 5⅛	..	..
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	5⅛	5⅛
110,000	Westminster Electric Supply, Ord.	5	10½%	10½%	12 %	12 — 13	12 — 13	12⅝	12 5/16
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6½ — 6⅝	6 — 6⅛	6 5/16	6

* Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS. Wednesday, May 27th.

CHEMICALS, &c.		Latest Price.	Week's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£4 10	..
a Bisulphide of Carbon	per ton	£15	..
a Borax	per ton	£13	..
a Benzole (90 %)	per gal.	7/-	..
a ,, (50/90 %)	per gal.	5/6	..
a Copper Sulphate	per ton	£21	..
a Lead, Nitrate	per ton	£24	..
a ,, White Sugar	per ton	£31	..
a ,, Peroxide	per ton	£27 10	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	..
a Potash, Bichromate, in casks	per lb.	3d.	..
a ,, Caustic (75/80%)	per ton	£24	..
a ,, Bisulphate	per ton	£35	..
a Shellac	per cwt.	125/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 5	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %)	per ton	£10 15	..
a ,, Crystals	per ton	£3	..
a ,, Bichromate, casks	per lb.	2½d.	..

METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£130	..
b ,, Wire, in ton lots	per ton	£168	..
b ,, Sheet, in ton lots	per ton	£166	..
p Babbitt's metal ingots	per ton	£43 to £145	..
c Brass (rolled metal 2" to 12") basis	per lb.	7¼d.	..
c ,, Tube (brazed)	per lb.	9¼d.	..
c ,, (solid drawn)	per lb.	7¾d.	..
c ,, Wire, basis	per lb.	7¾d.	..
c Copper Tubes (brazed)	per lb.	9¼d.	..
c ,, (solid drawn)	per lb.	9¾d.	..
g Copper Bars (best selected	per ton	£75	..

METALS, &c. (continued).		Latest Price.	Week's Inc. or Dec.
g Copper Sheet	per ton	£75	..
g ,, Rod	per ton	£75	..
e ,, (Electrolytic) Bars	per ton	£72	..
e ,, ,, Sheets	per ton	£88	..
e ,, ,, Rod	per ton	£78 10	..
e ,, ,, H.C. Wire	per lb.	8½d.	..
f Ebonite Rod	per lb.	8/-	..
f ,, Sheet	per lb.	5/-	..
n German Silver Wire	per lb.	1/6	..
h Gutta-percha fine	per lb.	8/-	..
h India-rubber, Para fine	per lb.	3/10½ to 3/11½	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	45/9	1d. dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£11 17 6 to £12	2/6 dec.
g ,, ,, Sheet	per ton	£14 10	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 12 6	..
d Mica (in original cases) small	per lb.	3d. to 1s.	..
d ,, ,, ,, medium	per lb.	2s. to 3/3	..
d ,, ,, ,, large	per lb.	3/6 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/2½	..
p ,, rolled bars & rods	per lb.	1/1 to 1/4	..
p ,, ,, strip & sheet	per lb.	From 1/3	..
o Platinum	per oz.	£4	..
p Silicium Bronze Wire	per lb.	10d. to 1/-	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
i ,, ,, in bars	per ton	£15 to £40	..
g Tin, Block	per ton	£131 to £132	£4 dec.
g ,, Foil	per lb.	1/6½	..
n ,, Wire, Nos. 1 to 16	per lb.	1/9	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£42 to £65	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7¾d.	..
j ,, 6 lea. Flax	per lb.	5¾d.	..
j ,, 3 ply 10 lbs. Russian	per lb.	4½d.	..
j ,, 10 lbs. Russian, single	per lb.	4½d.	..
j ,, 180 lbs. Jute rove	per ton	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£24 15	..

Quotations supplied by:—a Messrs. G. Boor & Co.; b The British Aluminium Co., Ltd.; c Messrs. Thos. Bolton & Sons., Ltd.; d Messrs. F. Wiggins & Sons; e Messrs. Frederick Smith & Co.: f India-Rubber, G.P. and Teleg. Works Co., Ltd.; g Messrs. James & Shakespeare; h Messrs. Edward Till & Co.; i Messrs. Bolling and Lowe; j Messrs. W. H. Hindley & Co.; k Messrs. Morris Ashby, Ltd.; m Messrs. W. T. Glover & Co., Ltd.; n Messrs. P. Ormiston & Sons; o Messrs. Johnson, Matthey & Co., Ltd.; p The Phosphor Bronze Co., Ltd.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RECEIPTS.

Locality.	Week ending	Receipts for the week.		Total to date.		Miles open.	
		£	£*	£	£*		*
Aberdeen	May 23	1,092	+312	48,869	+12,748	—	—
Birmingham	,, 23	5,232	— 89	103,452	+ 5,227	—	—
Bournemouth	,, 20	966	—	7,242	—	—	—
Blackburn	,, 23	791	— 202	6,874	+ 415	12½	+1½
Blackpool and Fleetwood	,, 23	331	—1026	5,511	— 717	7½	—
Bolton	,, 24	2,089	+ 23	14,241	+ 2,000	25	—
Bradford	,, 24	3,871	—197	27,580	+ 2,311	39	+2
Brighton	,, 24	921	— 31	20,021	—	6½	—
Bristol	,, 24	4,875	—905	—	—	28	—
Burnley	,, 23	784	— 2	—	—	—	—
British Elec. Trac. Co.:—							
Barnsley District	,, 15	172	—	2,230	—	—	—
Devonport	,, 15	416	+ 10	7,800	+ 268	5	—
Dudley—Stourbridge	,, 15	735	+ 58	14,102	+ 1,338	16½	—
Gateshead	,, 15	799	+107	15,767	+ 3,204	10½	+ ½
Gravesend—Northfleet	,, 15	229	—	3,675	—	3½	—
Greenock—Pt. Glasgow	,, 15	571	+ 43	8,700	+ 685	7½	—
Hartlepool	,, 15	229	+ 3	4,857	+ 468	6½	+2
Kidderminster	,, 15	104	+ 2	2,040	+ 107	4½	—
Merthyr	,, 15	198	+ 4	3,597	— 168	8	—
Middleton	,, 15	268	— 4	5,065	+ 191	9½	—
Oldham—Ashton	,, 15	542	+ 34	10,367	+ 1 122	8	—
Peterborough	,, 15	185	—	2,317	—	—	—
Poole	,, 15	238	+ 58	4,562	+ 906	9½	—
Potteries	,, 15	1,546	+109	29,229	+ 2,261	28½	—
Rothesay	,, 15	69	+ 30	1,194	+ 513	—	—
Sheerness	,, 13	81	—	531	—	—	—
Southport	,, 15	258	+ 43	4,746	+ 1,429	5½	—

Locality.	Week ending	Receipts for the week.		Total to date.		Miles open.	
		£	£*	£	£*		*
B.E.T. Co. (continued)—							
South Staffordshire	May 16	883	+ 94	14,563	+ 315	21½	—½
Swansea	,, 15	454	+ 23	8,558	+ 694	5½	—
Taunton	,, 15	57	— 9	1,022	— 57	1½	+1½
Tynemouth	,, 15	239	+ 88	4,414	+ 530	9½	—
Weston-super-Mare	,, 19	64	— 49	798	— 55	2½	+½
Wolverhampton Dist.	,, 15	852	+206	6,952	+ 3,980	10½	+8
Wrexham	,, 15	104	—	869	—	—	—
Yorks. Woollen Dist.	,, 15	283	—	2,797	—	6	—
Cardiff	,, 16	1,704	+633	11,741	+ 6,334	—	—
Dover	,, 23	216	— 49	3,864	+ 44	8	—
Dublin	,, 22	5,154	—851	89,991	+ 3,454	46	—
East Ham	,, 23	670	+128	4,798	+ 1,446	5	+ ½
Glasgow	,, 16	15,790	+4123	622,645	+33,541	64	+1½
Hull	,, 23	1,788	— 23	14,085	+ 1,299	—	—
Isle of Thanet	,, 23	486	—247	6,951	— 856	—	—
Liverpool	,, 16	9,816	+685	189,819	+10,016	101	+5
Manchester	,, 16	10,559	+7922	—	—	110	+85
Newcastle	,, 23	3,239	+259	—	—	17	—
Portsmouth	,, 23	1,689	+136	—	—	22	—
Salford	,, 18	3,051	+598	22,880	+ 6,519	—	—
Southampton	,, 21	998	—126	—	—	—	—
Sunderland	,, 18	1,073	+ 33	7,426	+ 337	20	—
Central London Railway	,, 23	6,962	+ 92	146,296	+ 6,223	3	—
Chatham & District Co.	,, 21	506	—	8,861	—	8½	—
City and S. London Ry.	,, 24	2,911	+ 27	65,786	+ 2,317	6½	+½
Dublin and Lucan Elwy.	,, 24	113	— 40	1,965	— 37	—	—
Liverpool Overhead Ry.	,, 24	1,649	+148	32,668	+ 2,761	6½	—

* Compared with the corresponding period of 1902.

A STUDY IN WHEEL TIRES.

A Belgian engineer, M. A. Spilberg, has contributed a paper to the Society of Belgian Engineers on the flanges of electrical tramcar wheels, showing a series of tire sections and the number of kilometres run by the tire in becoming reduced from the original state to this form. Some of the worn sections are peculiar. The cause of wear is usually sought in the rail itself or in the effect of curves. The wear of trailer cars is fairly regular, and does not present the same peculiarities. Such cars are but a third the weight of motor-cars; yet, if the peculiar shapes of wheel tread were wholly due to the rail, it would be natural to suppose that similar shapes would be found even under lighter trailer cars. Hence the author seeks for other causes. The track is composed of grooved rails of 1 metre gauge. It is but slightly curved. Current is supplied by trolley method, and the track is chiefly double; the cars have a seating capacity of 32. The truck is of the Franco-Belge type, with two axles and two motors of the Dulait system, excited in series and coupled in series parallel, and geared. The tires are of steel, and capable of changing shape not only by wear, but also by rolling pressure, for some of them show swelled projections beyond the original form.

On the whole, the wheels showing similar wear appear to be those diagonally placed to each other, and the gears are also diagonally placed. The impression which the wear conveys, is that the trucks are exposed to a horizontal rotative effect, forcing the backs of one of each pair of wheels against the side of the groove and the fronts of the other wheel flanges, for the wheels are many of them worn at the back, and even rolled out above the ring of contact.

The motors had already been frequently repaired, and the author attributes much of the trouble to them. He assumes that one pinion may be above the horizontal centre line and the other below it. Such a disposition, when the motors are between the two axles, produces a thrust in a horizontal direction upon the axles, tending to place the truck cross-cornered, and to thrust the back of one wheel flange against the rail and *vice versâ*. Where the car runs backward and forward, the wear of the wheels is not irregular when the pinions are placed as above, or when they are both equally above or equally below the horizontal diameter of their wheels, but exposed to different motor effort.

End thrust on an axle will be caused when the wheels are of different diameters, for the axle will be slightly inclined. The conclusions drawn are, that to ensure good working of a motor vehicle it is necessary that the wheels, the gears and the motors, and, in a word, all the parts which have the same function, should be identical. Further, the motor centres should be either at the same level as the axles, or, if not the same, equally removed from the horizontal. Nothing is said of double gears. We can scarcely doubt that much of the trouble of uneven wear of tires arises from the position of the motor gear at one end only of the motors. Could gearing also be double and symmetrically placed, the wear of both wheels and gears and bearings would be much reduced. The different levels of motor axis and axles would be of no account if it were not for the unsymmetrical single gears.

It is a mechanical error to allow a car motor to drive entirely from one end. The pinion naturally climbs up or down the face of the wheel, and one bearing of the motor wears more than the other. This sets the axis of the motor at an angle with the car axles, and throws all the stress upon one end of the gear teeth, which wear unevenly in consequence, and an end thrust is produced upon the axles. This point is not treated in the paper.

Where wheel bases are short, the disturbing actions will all be more accentuated. If gears were doubled, it would not be necessary that they should be even half as wide as at present. The ordinary wide gear now used receives all the stress on one corner, and yet does not break. Two gears, each of half width, would, under such circumstances, be twice as strong as the single gear, and would not be so liable to become askew. The excuse that there is not space for two gears, therefore loses its force when these points are considered, and the first tramway manager who has courage to depart from the present bad practice will probably find that he has economised very greatly in repairs and renewals of gears and motor axles and bearings. The present system appears to be of American origin, and it is evidently of a kind that one could well do without.

ELECTRIC DRIVING IN MACHINE SHOPS, ENGINEERING AND SHIPBUILDING WORKS.

(*Concluded from page* 894).

In discussing the various forms of gearing, Mr. Williamson considers that for general purposes the only useful types are spur gear, chain and belting.

Worm gear he considers expensive, and to be efficient must be fitted with ball thrusts.

For spur gearing the author considers 1,000 ft. per minute is the limit for metal gears on account of noise, but with raw hide and metal 2,000 ft. a minute can be run.

Chain drives are only suitable in shops free from grit and dust, unless special means are taken to case them in well. A reduction of 6 to 1, with 4 ft. centres can be obtained, as a chain wheel may be smaller than a belt pulley transmitting the same power.

The author does not say if he has had any experience with chain-driving machines having very variable loads. In our experience Renold's chains, whilst satisfactory for driving line shafts or machines taking a steady load, are not so satisfactory for intermittent or rapidly varying loads. Under these conditions, they stretch rapidly and unevenly, and ride on the teeth of the wheels unless very wide chains are used having a large margin of power.

A somewhat interesting, and, to some extent, novel application is described in connection with the driving of a portable vertical planer or slotting machine. A 5-H.P. motor, with a speed range of from 300 to 900 revolutions per minute, is attached direct to the machine.

On the cutting stroke the motor runs at its slowest speed, and at the end of the stroke, which is adjusted to suit the work, the motor reverses automatically. A resistance is automatically inserted in the shunt, as soon as the reversal has taken place, raising the speed to 900 for the return stroke. At the end of the return stroke the resistance is short-circuited, and the motor then reverses and performs the slow-cutting stroke again.

The novelty of the application lies in the insertion and short-circuiting of the shunt resistance. Reversing motors have been used before for the small planers and shavers used in connection with printing machinery. The motors are generally series-wound, so that the quick return is automatic without field resistance. It strikes one as being rather rough on the motor to reverse it so rapidly, but if, as the author says, the excess current on reversal can be reduced to a negligible quantity, there is no doubt a large field for such applications.

The most valuable part of the paper is that which deals with the actual powers taken by various machine tools when doing specific work. The first-class of machines dealt with is lathes.

1. A 36-in. centre lathe, 90 ft. long, driven from a geared countershaft by a 10-H.P. shunt motor, turning a 9·2-in. gun tube in hard steel, weighing 5 tons, having a diameter of 20 in., at a cutting speed of 5 ft. per minute, took 6·8 B.H.P. when taking four cuts $\frac{5}{16}$ in. × $\frac{3}{16}$ in. traverse, and 7·5 B.H.P. when taking four cuts $\frac{7}{16}$ in. × $\frac{1}{4}$ in. traverse.

The same lathe when turning a mild steel shaft 11 in. diameter, 16 ft. long, at a cutting speed of 10 ft. per minute, took—

3·1 B.H.P. with no cut on.	7·0 B.H.P. with three cuts.
4·6 „ „ one „	9·4 „ „ four „
5·5 „ „ two „	10·5 after half-an-hour's run.

2. Similar lathe to above, turning a 23-ton gun tube, hard steel, at 5 ft. per minute, 10·7 B.H.P. with four cuts $\frac{3}{4}$ in × $\frac{1}{4}$ in. traverse. 3. 40 in. centre lathe turning a mild steel shaft 36 ft. long, 18 in. in diameter, 24 tons; 9 H.P. with four parting cuts 1$\frac{1}{2}$ in. wide, ·05 traverse. 3·5 H.P. with no cut.

The useful power required to drive a lathe, that is, the power over and above that required to drive the work with no cut, should bear some definite ratio to the weight of metal removed per hour. In the following table Mr. Williamson gives the B.H.P. absorbed at various cutting speeds, and the

total weight of metal removed per hour. From these figures the weight of metal per B.H.P.-hour can be obtained, and this information is given in the last column :—

Tests of Power taken by Lathes Using Vickers' High-speed Tool Steel.

Lathe centres.	Material.	Cutting speed per min.	No. of tools.	Lbs. of metal per hour.	Cut.	Traverse.	B.H.P.	Lbs. of metal per B.H.P.-hour.
36 in.	Gun steel	12 ft.	1	187	·38 in.	·166 in.	9	21
„	„	21 ft.	1	280	·38 in.	·166 in.	15·4	18·2
„	„	32 ft.	1	360	·26 in.	·166 in.	15·4	23·4
„	„	12 ft.	4	460	·28 in.	·166 in.	19·8	23·2
„	Gun (very hard)	8 ft.	4	110	·50 in.	·143 in.	15·0	7·33
„	Gun steel ingot.	51 ft.	1	502	·99 in.	·05 in.	25·5	19·7
„	Gun steel ingot.	48 ft.	1	570	·58 in.	·10 in.	33·0	17·3
„	Marine shaft (32 tons tensile).	50 ft.	1	480	·50 in.	·10 in.	22·0	21·8
40 in	Marine shaft.	13·5 ft	8	900	·3 in.	·25 in.	39	23
30 in.	Gun steel.	18 ft.	2	795	·45 in	·188 in	30	26·5

Note.—Allowing a tool to cut at such a rate that it requires grinding after two hours' work, the weight removed per hour is about 220 lbs. per tool, and the B.H.P. is about 11 per tool. A lathe with four tool posts can therefore absorb over 40 H.P, but as the four tools are not always cutting equally heavily in roughing, most of the lathes used for roughing in the Sheffield works have motors of 30 B.H.P, with overload capacity up to 40 B.H.P.

Twenty lathes of from 30-in. to 40-in. centres are having 30-H.P. motors fitted in place of the former 10-H.P. motors.

The above figures require a little explanation. In the first and second tests the cut and traverse are the same, so the weight of metal turned off in a given time should be proportional to the cutting speed. This would give 327 lbs. instead of 280. On the other hand, the powers given are almost exactly in proportion to the cutting speed, from which it would follow that the power required to drive the lathe with no cut varies also as the speed.

Another point suggested by the above table is that there may be for each tool a certain combination of cut and cutting speed which gives the best all-round results, both as regards the weight removed per hour and per B.H.P. per hour. Thus, in test No. 3 the cutting speed is raised to 32 ft. per minute, and by reducing the cut from ·38 in. to ·26 in., the power is the same as in No. 2, but the weight of metal removed is increased by over 28 per cent., the weight per B.H.P. per hour being, of course, increased in the same ratio. It would, therefore, be very interesting and instructive if further tests could be made to show the effect on the power taken and the weight removed, of gradually increasing the cutting speed, keeping cut and traverse the same; keeping the speed constant and increasing the cut; keeping speed and cut constant and increasing the traverse.

Boring Machines.

1. 24-in. centre gun-boring lathe; boring 8-in. hole out of the solid, 3 in. per hour (ordinary tool steel); 5·4 B.H.P., 5·7 lb. steel per B.H.P.-hour.

2. Ingot and tube-boring machine; boring 9-in. hole out of the solid in 27-ton gun forging which is rotated; traverse, 2½ in. per hour; 5·5 B H P., 8·4 lb. steel per B.H.P.-hour.

Same Machine.—Boring 12-in. hole from solid in 15-ton ingot; traverse, 2½ in.; 7·2 B.H.P., 11·25 lbs. steel per B.H.P.-hour.

3. Double-barrel boring machine for 6-in. guns. Boring a gun-tube from both ends, $7\frac{7}{16}$ in. at one end and 6½ in. at the other end, 2½ in. traverse at each end; B.H.P. = 8·04; lb. of steel per B.H.P.-hour = 7·54.

4. 6-in. gun-boring machine; boring $5\frac{1}{16}$ in. hole out of solid gun-steel at 42 in. per hour (21 in. each end) with Vickers' high-speed steel = 25·5 B.H.P.

Planing Machines.

1. *12 ft. × 12 ft. by 25 ft. 6 in. stroke.*—Parting a 12-in. nickel-steel armour plate, 23 tons; two tools 1½ in. wide; cutting speed 12·5 ft per minute; return stroke 30 ft. per minute; cutting and returning 17 B H.P.; reversing 70 B H P.

2. *Heavy Armour-plate Planer*, 10 ft. 6 in. × 10 ft. 6 in. by 25 ft. stroke; running without cut, 4 tons on table, cutting stroke 4 B.H.P.; reversing, 20 B H.P.; return stroke, 9 B.H.P.; reversing, 12·5 B H.P.; each tool 1½ in. wide cutting nickel-steel = 2 B H.P.

3. *Same machine*, with 12 in. nickel-steel plate, 30 tons; cutting stroke, but with no cut on, 7 B.H.P.; reversing, 24 B.H.P.; quick return stroke, 15 B H.P; reversing, 15 B.H.P; each tool 1½ in. wide = 2 B.H.P., cutting Harveyised surface at 5 ft. per minute.

4. *Side planer for armour plates.*—6-in. nickel armour plate, cutting both directions; running without cut, 1·4 B.H.P.; cutting tool, ⅜ in. wide. (*a*) Cutting the hard face, 5 ft. per minute, 4 B.H.P.; (*b*) cutting below hard face, 9 ft. per minute, 5·5 B H.P.

5. *Planer, 4 ft. 6 in. × 4 ft. 6 in. by 12 ft. stroke.*—Running on loose pulley, 3 B H.P.; running machine, without cut, 3 B H.P.; planing steel forging, 30 cwt., 19·5 ft. per minute, two tools = 5 B H P; reversing, 25 B H.P.; return stroke, 69 ft. per minute = 7 B.H P. The power taken on reversing was reduced to 16 B.H P. by fitting the motor with a disc fly-wheel, 33 in. × 2½ in.; speed of motor, 600 revolutions per minute.

6. *Planer, 5 ft. 6 in. × 5 ft. 6 in. × 12 ft. stroke.*—Planing cast-iron motor frames; cut ¼ in. × $\frac{1}{16}$ in., 16 ft. per minute (2 tools); quick return, 43 ft per minute, 5 B.H.P.; reversing takes 15 B.H.P.; cutting takes 4·5 B.H P.

Slotting Machines.

1. *Machine, 30 in. stroke slotter.*

Work, slotting gun-breech ring, about 24-in. stroke; (1) cut ¼ in. × $\frac{3}{16}$ in. traverse, 2 B.H P.; (2) roughing cut ⅜ in. × $\frac{3}{16}$ in. traverse, 4·5 B.H P.; quick return stroke, 1 B.H.P.; (3) the heaviest observed current on any work which the machine will do was equal to 6 B.H P.

2 *Machine, 30-in. stroke slotter.*

Work cutting mild steel, 1½ in. × $\frac{1}{16}$ in. traverse, 28-in. stroke; cutting 7 B H P.; reverse, 9 B.H.P.; quick return, 5 B H P.; reverse, 7 B.H.P.; 9 lbs. of steel per B.H P.-hour.

Shipyard Plate Machines.

1. *Machine, large plate rolls, 30 in. wide.*

Motor, 45 B.H P, series reversing, 450 r.p.m., enclosed.

Work, reversing rolls, about 50 B.H.P (momentary); running rolls light, 15 B H.P.; bending 16 ft. × 1¾ in. cold plate; reversing rolls up to 80 B H P. (momentary); running 25 to 30 B.H.P.; a magnetic brake was fitted to stop the motor quickly. It lifted at 45 amperes.

2. *Lifting gear for above rolls. Top roll, 30 in. diameter.*

Gear, bevel and worm gear, reduction 100 to 1.

Motor, two 10 B.H.P series, 600 r.p.m., one each end of roll.

Work, raising one end, 10 B.H.P.; raising both ends, 18 B.H P.; lowering one end, 8 B.H P; lowering both ends, 15 B H.P.

3. *Vertical Rolls, 6 ft. 3 in.*—Bending 3 in. nickel steel gun shield to 24 in. radius at dull red heat; power averaged, 25 B.H.P.; maximum, 35 B.H.P. As the work was intermittent, a 22-B.H.P. tramway motor was found to be strong enough.

4. Auxiliary motor for feeding the rolls = 5 B H.P.

5. *Boiler Shop Rolls, 10 in.*—Driving open and crossed belts = 3·5 B.H P.; rolling $\frac{5}{16}$ in. cold plate into 19 in. diameter tube, 8 ft. 2 in long, 11 B.H.P.

6. *Shipyard Rolls, 20 ft. 6 in.*—Rolling ⅝ in. plate, 30 in. wide, 9 B.H P.; rolling ½-in. plate, 15 in. wide, 12 B.H.P.

7. *Plate Straightener* ("*Mangle*").—Running light = 3 B.H.P.; rolling ½-in. plate, cold, 42 in. wide, 4 B.H P.; rolling ⅜-in. plate, cold, 48 in. wide, 8 B.H.P.; reversing = 10 B H.P.

8. *Small Shearing Machine.*—Running light, 1·5 B H P.; shearing one ⅝-in. rivet at a time = 3 B.H.P.; shearing three ⅝-in. rivets at a time = 4½ B.H P.

9. *Punching and Shearing Machine.*—Punching 1¼-in. holes in ⅝-in. plate = 6 B H P.; shearing ⅝-in. plate = 9 B.H.P.

10. *Heavy Punching and Shearing Machine.*—Running light at 26½ strokes a minute = 3·5 B H.P.; shearing 1-in. plate, 17 to 24 H.P., depending on length of plate; punching 1-in. holes in ⅝-in. plate = 7 B H.P.

11. *Horizontal Punching and Shearing Machine.*—Running light at 30 strokes a minute = 2·5 B H.P.

Shearing angle	bar	5 in. ×	3½ × ½ in.	= 5	B.H.P.
„	bulb	„ 9 in. ×	3½ × 1 in.	= 9	„
„	angle	6 in. ×	6 × ⅝ in.	= 13	„
„	bar	6 in. ×	½ in.	= 5	„
„	angle	3 in. ×	2⅝ × ⅝ in.	= 3	„

12. *Bar and Rail Straightener.*—Fly-wheel weighs 1 ton; running light = 2 B.H P.; rail straightening, 2½ B.H P.; starting = 10 B H P.

13. *Three-plate Counter-sinking Machine.*—Running three belts on loose pulleys, 2 B.H.P.; running three machines light = 3½ B H.P. counter-sinking three 1⅛-in. holes in ⅜-in. plates = 11 B.H.P.; tool speed, 130 r.p.m.

14. *Large Edge Planer* (*25-ft. Stroke*).—Planing 1-in. plate $\frac{1}{10}$-in cut, 14 ft. per minute = 18 B.H.P.

15. *Small Edge Planer* (*12-ft. Stroke*).—Planing 2½ in. × $\frac{1}{16}$ in. deep at 14 ft. per minute = 15 B.H P.

Metal Saws.

1. *Armour-plate sawing machine.*—Saw 38 in. diameter × ⅝ in. thick, teeth running at 13·5 ft. per minute; sawing armour plate 2½ in. thick at 9 in. per hour = 3 B H.P.

2. Double do.—Sawing two plates 2½ in. and 2 in. thick respectively, at 6 in and 10 in. per hour respectively; teeth speed, 15·7 ft per minute = 7 B H P

3. *Crank web sawing machine.*—Sawing loco. crank 13 in. deep; two saws, each 47 in. × ⅛ in., at 3·6 in. per hour; teeth speed, 10 ft. per minute = 2·25 B H.P.; 15 lbs. of steel removed per B H.P. per hour.

4. *Band saw* $\frac{1}{10}$ in. thick, running at 132 ft. per minute; feed, ⅛ in. per minute; sawing steel ingot 14 in. deep = 0·9 B.H.P.

Wood-Working Machines.

1. 35-in. circular saw, sawing 10-in. teak, about 8 ft. per minute = 14 B.H.P.

2. 24-in. circular saw, sawing 6-in. beech, about 4 ft. per minute = 4 B.H.P.; circular saw, sawing 2-in. white pine, about 10 ft. per minute = 2·75 B.H.P.; speed of saw and motor, 1,500 revolutions per minute; running light, 0·55 B.H.P.

3. *24-in. circular saw at* 1,000 *revolutions per minute*, 5-in. ash at 10 ft. per minute = 6 B.H.P.

4. *Sawmill Circular Saw (to take up to 60-in. diameter).*—Speed, 750 revolutions per minute, driven by belt; sawing damp pitch pine 12 ft. per minute, 10 to 17 in. thick (average 14 in.); power taken, 21 to 36 B.H.P. (average 26).

5. *Band Saw ½-in. wide.*—Running at 3,670 ft. per minute.

Sawing 3½-in. Kauri pine = 1·43 B.H.P.
" 9¾-in. " " = 2·8 "
" 7½-in. yellow " = 1·63 "

6. *Grating Saw.*—Cutting four grooves 1⅞ in. wide × ⅜ in. deep, at 2 ft. per minute, 10 B.H.P.; running light, 2½ B.H.P.

7. *Wood Planer* (36 *in. wide*).—Running light, 2½ B.H.P.

Planing pine 27 in. wide; $\frac{3}{16}$-in. cut.; 14 ft. per min. = 8 B.H.P.
" teak 12½ " ; $\frac{3}{16}$ " ; 14 " " = 6 "
" " 22½ " ; ¼ " ; 14 " " = 7 "

8. *Wood Planer* (24 *in. wide*).—2,200 revolutions per minute.

Planing pine 16¼ in.; ⅛-in. cut; 14·5 ft. per min. = 3·25 B.H.P.
" " 16¼ " ; $\frac{1}{32}$ " ; 14·5 " " = 2·5 "
" " 14 " ; ⅛ " ; 14·5 " " = 3 "

9. *Wood-moulding Machine.*—Cutting teak about 5 in. square on three sides, and ploughing fourth side; 13 ft. per minute = 10·5 B.H.P.

Special Machines.

1. *Wellman charging machine for steel furnaces.*—Three 25-H.P. tramway motors are used, one each for the travelling, traversing and lifting motions, and a 5-H.P. motor for the turning gear. The power taken varies from 7 to 70 B.H.P. The tubs hold 3 tons, and a 40-ton furnace is charged in half an hour, as against four hours by manual labour. The advantages over manual charging are a reduction of 50 per cent. in wages, an increased output of 25 per cent., and a reduction in the cost of repairs. The 40-ton charge takes three B. of T. units = 2½d.

2. *Power hammer, 5-cwt. size.*—Hammering out wedges 6 in. × 8 in. × 1 in. tapered to nothing = 4·75 to 10 B.H.P. A series-wound motor would be best for this, as it would slow down on cushioning, and take about 6 or 7 B.H.P.

3. *Stern tube-boring machine*, driven through worm gear; speed of bar, 1·36 r.p.m.; diameter of hole bored = 26½ in.; cutting speed of tools, 9·5 ft. per minute. With four tools cutting $\frac{3}{16}$ in. = 10·1 B.H.P.

Fans and Blowers.

1. *Root's Blower*, for 2-ton converter, takes 40 B.H.P., with a pressure of 1·5 lbs in converter, and 61·5 B.H.P. with 2·5 lbs

2. Ditto. *for Cupola.*—Melting 8 to 9 tons an hour, with 14 to 15 oz. pressure in cupola = 70 to 73 B.H.P.

3. Ditto. for 3 to 4 tons per hour. With 9 to 10 oz. pressure in cupola = 34 to 37 B.H.P.

4. *Sturtevant Fan* for steel foundry cupola, 2 to 4½ tons an hour; running light, 11 B.H.P.; blowing, 12 B.H.P.

5. Fan for nine smiths' fires, 5 to 5·5 B.H.P.

6. Fan for 3 smiths' fires, 8·5 B.H.P.

7. *Root's Blower No.* 2 "1900" *Pattern.*—190 revolutions per minute = 6·4 B.H.P.

8. *Air Compressor for Pneumatic Tools*, four 10 × 6 in. cylinders; air pressure, 70 lbs. per sq. in.; driving six chipping tools and three drills = 15·3 B.H.P.

9. *Portable Painting and Lime-Washing Machine*, driven through single-reduction worm gear; air pressure, 10 lbs.; working two paint sprays = 2·6 B.H.P.

A table of powers taken by line shafting is given. The power for ordinary cases varies from about 5½ to 13 B.H.P. per 100 ft. of 3 to 3½ in. shafting, the average being 9·1.

A table of figures is also given relating to the B.H.P. of motors installed per 1,000 sq. ft. of shop area. For these and fuller information as to the sizes of motors used for the various machines and the methods of gearing employed, readers are referred to the original papers. As regards the lighting arrangements, the figures given by the author are summarised as below, the figures referring to 500 watt arc lamps.

Heavy machine shops (average height of lamps = 35 ft.) = 400 watts per 1,000 sq. ft. of floor area.

Light work (average height of lamps = 16 ft.) = 375 watts per 1,000 sq. ft.

Foundries and steel foundries = 240 watts per 1,000 sq. ft.; forge, about 350 watts per 1,000 sq. ft.

LAY PRESS TECHNICS.

Lord Kelvin has stated that it is easier to conceive the infinite than the finite. Certain recent events have led us to the conclusion that the gullibility of the lay press must have been in his mind when making the above statement.

The *Daily Express* of April 30th contained an article entitled "Electricity from the Clouds." The article proceeds in all seriousness to describe a "dazzling scheme for tapping the inexhaustible electrical power of the skies," which, it is perhaps needless to say, is to be put into operation in the United States. The article goes on to describe how this is to be done.

It is extremely simple in theory. Seven acres of land have been acquired and the initial plant will be built there, and "the induction and distribution of electricity begun." It is also stated that the plans of the building and the machinery are all made and provide for the distribution of 140,000 H.P. From the roof of the building an insulated copper cable ⅜ in. in diameter will "extend upwards" for 125 miles. There it will be fastened to a spherical ball or generator. (To place the shape of the generator beyond a doubt, it might have been mentioned that the spherical ball will be round). Above this generator will be a steel cable of two strands each $\frac{1}{16}$ of an inch in diameter. This steel cable will be 102 miles in length. 37½ miles above the generator there will be another steel ball weighing 10 ounces, and another steel cable (dimensions not stated), 27 miles long, will extend upwards and connect there ("there" is a little vague) with an aluminium cable ½ in. in diameter. This aluminium cable will be 48 miles long, and will terminate in a silver ball weighing 3½ ounces. As the silver ball will therefore be some 275 miles above the surface of the earth, it is considered to be beyond the reach of ordinary thieves. The article goes on to say that this electrical "ladder" will extend into the region of the ether beyond the earth's atmosphere, and that the ether occupies the whole space between the sun and the planet (which planet is not specifically stated) and the stars. This is certainly going a long way, but appears to somewhat limit the extent of the ether, and to leave us in doubt as to what may exist in the space beyond the stars.

The writer of the article appears at this point to have been seized with some misgiving as to how the 275 miles of copper, steel, and aluminium cables are to be supported, but he naively remarks that this is "still the inventor's secret," and that the inventor declares that the methods and principles involved are well known to science, and that it is merely a question of applying them. It is further stated that once the "ladder" reaches into space it will remain there *for ever*, as it will be supported "by the natural forces of the universe." In order to account for this remarkable phenomenon the inventor claims to have discovered "the magnetic centre," which "strongly draws away that part of the cable outside of the earth's atmosphere, and thus keeps the whole cable upright and taut."

It may be mentioned that two woodcuts divide the text of this article, and, although they appear to have reference to some other scientific discovery they are somewhat apposite. One represents a human head with a portion of the brain laid bare which is being stirred up by a brush, and is intended to show "the brain centre, injury to which causes loss of self-control." And the second purports to illustrate the character of "sluggish blood whose owner has criminal possibilities."

Is it possible that the newly-discovered magnetic centre has unconsciously drawn these tributes to the genius of the inventor into juxtaposition with the description of his invention?

The second instance of fooling the press occurred somewhat earlier in the month. The victim in this case was the *Morning Leader*. We think that there is a certain family likeness between the designed insanity shown in the description of the alleged means of communicating with interstellar space quoted above and the three letters which we reproduce below—our readers may judge for themselves.

These letters are put forward by the *Morning Leader* as worthy contributions to a serious scientific controversy, namely, the question of the nature of the material used in the construction of the *Discovery*.

The first of these letters appeared appropriately enough on April 1st, and is as follows:—

"The 'Discovery.'

"Sir,—'Sympathiser' has evidently not taken into consideration the effect of salt water on Eichenflopper steel plates in such a low temperature. These plates, as every practical engineer should know, are rivetted by the best copper mergugger bolts, which bring leakage to a minimum.

"A slight leakage, however, was inevitable, taking into consideration the action of animalculæ and the straining owing to the pressure of the pack ice and the under-currents, of which navigators know nothing.

"Yours, &c.,
"F. Hinton Fraser."

This was followed a fortnight later by letter No. 2, which runs as follows:—

"The 'Discovery.'

"Sir,—With reference to the leakage that befel the *Discovery* during her successful trip towards the Southern Pole, I quite agree with Mr. Hinton Fraser that the Eichenflopper plates used on that occasion were in every way a success, and leakage was brought to a minimum.

"This discussion recalls to me the trip of the whaling sloop *Urumtee* in 1876, when this vessel was chartered by Capt. von Steiner, an enthusiastic Polar explorer.

"On the vessel's arrival at Solothurn, I had the honour of boarding her and making experiments with the plates on this vessel, and applied the celebrated Eisbein test, calcium oxide.

"I found that molar indentation of animalculæ had taken place, and the vessel had leaked in consequence.

"Yours, &c.,
"H. Macbeal."

And emboldened by success the practical joker resolved to further test the extent to which the *Morning Leader* would swallow manifest absurdities and concocted letter No. 3, which we must admit is *facile princeps* in the art of absolutely blatant idiocy.

"The 'Discovery.'

"Sir,—I feel greatly interested in the discussion as to the merits of Eichenflopper plates being carried on in your valuable paper.

"Some three years ago, through the courtesy of the manager, I was shown over the works at Andermatt, where these plates are manufactured, and where most of the world's biggest ships are fitted. I was greatly struck with the huge stack of machinery used in the punching of the rivet crafters and lumbers, and the great precaution taken to prevent warping of the steel grungers that overlap the bilgers which the plates are cast from. The exactness of the grab chain when entering the flying wood crank was astounding. The fritishness caused by the slinging bungers can be distinctly felt by placing one's hand on or near any small quantity of waste or fire damp when the pressure gauge indicates 80 per cent. lbs. to the inch, which pressure the *Discovery* had to undergo.

"As all engineers know, in fixing the plates, the pressure (automatic) should be placed clear of the plate, to allow for the warping, and the steam would consequently clink the top-flying clunkers, instead of there being any chance of clunking the clinkers, as in the case of the *Discovery*.

"Yours, &c.,

Fredk. Tinson."

Of course, the intention to be idiotic is so obvious that comment thereon is needless, but some of the ideas of the writer are really quite ingenious and amusing. Take, for instance, the alleged detection on the steel plates of a vessel of the "molar indentation of animalculæ." Or the daring absurdity of speaking of a vessel's arrival at Solothurn, which is a town in the centre of Switzerland, and the perfectly delightful reference to works at Andermatt "where most of the world's biggest ships are fitted."

We have frequently adverted to the ridiculous position in which the lay press often places itself owing to the ignorance or incompetence or conceit of the members of the staff who deal with descriptions of technical subjects, and the instances which we have quoted above certainly go far to show that as a means of educating the public the lay press is still far behind what it ought to be.

MR. AUSTEN CHAMBERLAIN'S COMMITTEE.

By CHAS. H. GARLAND.

To those who have watched closely the trend of events, there have not been wanting signs for some months back that there was to be a change in the attitude of the Postmaster-General towards the complaints of his minor establishment. At the commencement of the current year these signs became more distinct, and it was certain that the demand for an inquiry when next made in the House of Commons could not be effectively countered by the absolute negative. First, there was the increasing number of members on either side of the House who were pledged when candidates for Parliament to vote in favour of an inquiry; then there was the increasing attention being paid to social questions after the termination of the war, a fact that was getting underlined at every bye-election; and, further, there was the nearing prospect of a general election rendering members increasingly anxious to make some show of fulfilment of their pledges. Within the Post Office, too, there were influences at work. The whole telegraph house was being put in order to welcome the visit of the delegates to the International Telegraph Conference, and an energetic demonstration of a discontended staff was among the things to be avoided. To crown this the nominee of a Postal Organisation had become the accepted candidate at York City, where with Liberal aid there was a good chance of his being returned. By a supreme effort of organisation, a conference of Unionist M.P.'s, who were pledged as candidates to a Postal Inquiry was called on February 26th, under the presidency of Sir Albert K. Rollit, and it was decided (1) to organise a deputation to Mr. Austen Chamberlain from his own side of the House of Commons; and (2) to sign a petition also from his own side of the House, urging him to appoint a Select Committee to make inquiry into the alleged grievances of the Postal employés. So successful were these operations, that the aid of a total of 85 Unionist members was obtained, and so conscious were these gentlemen that "something would be done," and that this "something" depended largely on the trend of the political movement in the country, that one well-known Unionist M.P. said to me on February 26th, "If Crooks wins Woolwich, you will get your inquiry." Woolwich was won on a Government labour question largely, and the issue of the Postal movement was no longer uncertain. On March 26th Mr. Chamberlain received a large and imposing deputation of Unionist M.P.s, who for the first time in such circumstances were accompanied by two of the Postal employés, who were allowed to state a case for inquiry. It became an open secret from that time that some means was to be found to help the Unionist members to fulfil their pledges to their constituents and to pacify the aggrieved staffs. The question only remained, How was this to be done? When the Post Office vote came up for discussion on April 30th Mr. Chamberlain announced his decision.

Bearing in mind the ends to be attained, the method adopted was a singularly unfortunate one. To my mind two courses were open to the Postmaster-General. First, to keep the reins in his own hands and boldly set about the necessary inquiry and reforms himself; or, secondly, with equal courage to appoint a really impartial and properly constituted board of arbitration to do the work for him. He has adopted neither of these courses, and as a result he fails in all his aims, and in addition sets a premium on agitation. I will show as briefly as possible how this happens.

Recognising that the questions at issue were largely matters of dispute between themselves and the administrative officers, and that both parties to the dispute were liable to take a biassed view; and, further, recognising also that all reform should be preceded by inquiry, the men have for years asked for such an inquiry. The particular form of inquiry which seemed to offer a fair guarantee of impartiality and public responsibility was a Select Committee of the House of Commons. The House of Commons offers a wide field of choice, and among its lawyers, business men and other classes possesses an abundant supply of the necessary abilities. In addition, the method of appointing such Committees is so scrupulously honourable as to carry confidence to all parties. But the Postmaster-General says that such a Committee is the most unsuitable tribunal he can imagine to deal with the subject, and the only tangible reason he urges in support of his opinion is that a Select Committee would be subject to "electoral pressure." The "electoral pressure" of postal employés is represented by a total of 40,000 members of organisations scattered over 670 constituencies, and cannot possibly be such a terrifying influence as we are asked to believe. And, as if to accentuate the fact that this alleged reason is only an excuse, there is at present sitting a Commission on Civil Service Superannuation, in which all these 40,000 postal employés, and a host of others besides, are interested, upon which there are members of the House of Commons! And no suggestion or complaint of electoral pressure has arisen. But for this reason Mr. Austen Chamberlain avoids the tribunal asked for, and by the decision of which the men are pledged to abide, be it favourable or unfavourable to their claims, and he makes the following proposals:—

To appoint "a small body of men—I hope not more than five—of practical experience who will consent to examine the scales of wages now paid, and will report for my information whether they consider them adequate or not. I do not wish to pledge myself to the terms which I am now going to read, for I have not had time to fully consider them. But in order to give the Committee an indication of what I have in my mind, I will say that the reference should be something of this kind: 'To inquire into the remuneration of the undermentioned classes of Post Office servants, and to report whether, having regard to the rates of wages current in other employments the rates of postmen, sorters (London), telegraphists (London), and sorting clerks and telegraphists (provincial) are adequate.' These are the great classes of Post Office employés. If I am fortunate enough to obtain the services of gentlemen who will give the time and experience which are necessary for this inquiry, I shall hope that they will be able to give me a general opinion on the scales of these main classes, and that, in the light of the standard so set up, I shall be able to deal, if I am then in office, and, if not, my successor will be able to deal, with the claims of the minor bodies who are not actually included in the list I have read out."

There is a distinct advantage in being able to criticise this proposal before the names of the Committee are announced, as it becomes thus easy to escape any suspicion of personality. Such a committee will be amenable to nobody, and its decisions cannot carry the weight of a body of responsible representative men. It is chosen by one party to the dispute, and its decisions will only, in all probability, be communicated to that party, and eventually the final decision must rest with the Postmaster-General. For it depends on him whether he makes the decisions public, and further whether he carries them out. To the men then it cannot appeal as an arbitration board. Nor, indeed, can anybody conversant with the principle of arbitration pretend that such a body should be permitted even to masquerade as an arbitration board. It is to be selected apparently entirely from one class: the employer class; and the employed will have no representation on it. It will, therefore, from its very constitution frustrate the aim of pacifying the staffs, and will not allow the pledged members of Parliament to claim that their pledge has in any way been fulfilled. For the underlying principle of their promise was to get an independent impartial inquiry.

But even did the constitution give satisfaction, the terms of reference exclude such a consummation. They embrace wages only, and however sordid the Postal employés may be suspected of being, they are not so sordid as to set up the question of wages as of first importance to the exclusion of all else. There are other questions of wide social and service import which require settlement. Among others I would enumerate:—

(*a*) Civil rights.
(*b*) Right of combination.
(*c*) Special leave for combination purposes.
(*d*) Insanitary offices.
(*e*) Insufficient meal relief, and a number of minor topics. Nor is it clear that the question of the "breach of faith" alleged by the London men with regard to their maximum salary will fall within the scope of the inquiry. Without a settlement of this vexed question, the Metropolitan men will know no peace.

And if these matters are not sufficiently convincing as to the Committee's inability to secure the ends apparently aimed at, there is even worse behind. In limiting the inquiry to the four classes named, Mr. Austen Chamberlain is obviously yielding to the very force he claims to protect hon. members from, and setting a distinct premium on agitation. For the classes named are not the worst paid or the most numerous of the minor establishment, but they are

the best organised. Excluded from the inquiry are the 81,410 persons employed in unestablished positions, or auxiliaries, the very worst paid and treated of the Postal army. Excluded also are the 21,220 sub-postmasters, and over 6,000 porters, linemen, tube attendants, tracers, &c., who are all on the very lowest scales of pay. The classes included number only, roughly, 60,000 as against 108,000 excluded. But the included classes are highly organised and persistent in the pursuit of their claims, and the lesson to be read is therefore unmistakeable.

Mr. Chamberlain has granted this inquiry in order (1) to assist his Unionist friends to fulfil their election pledges; and (2) to pacify his staff. The composition of the body and its terms of reference preclude any such result, and will not even stop Parliamentary agitation. The resumed debate on May 11th proved that it did not bring satisfaction even on his own side of the House. If he still desires to succeed, even in part, in his aims, I would suggest to him that he use this Committee merely as an advisory body, and gripping the situation courageously and avoiding half courses, deal with the questions himself and on his own responsibility. Failing that he might well put his faith in the integrity and impartiality of a Select Committee of the House of Commons. His present proposal displays but little courage and offers but small hope of success.

LIQUID FUEL FOR POWER PURPOSES.

An excellent *résumé* of the present position of the liquid fuel question appears in the *Engineering Magazine.* As far back as 1887 the Pennsylvania Railroad found oil to be a satisfactory fuel, but as they would have required 52,000 barrels per day for the whole line the idea was given up, as such a consumption would have probably put up the price of liquid fuel and cut down the economy to a negative figure. Similarly the Chicago, Burlington and Quincy line could not see their way to the use of liquid fuel some six years later. Since new oil fields have been found, however, more has been done. Many concerns in America—perhaps near the fields—have adopted liquid fuel. Even in the Eastern States some are using it in preference to coal, and some American steam ships have been fitted for its use. Experiments have also been made by the U.S. Navy department, which have shown fair results. The boiler experimented upon was not of very suitable type, however, and it is no matter of surprise that the results were not smokeless. Still the Bureau of Steam Engineering recommend that one-third of the torpedo boats and destroyers should be fitted with liquid fuel. In California and Texas, of course, oil has a decided advantage over coal, and its use is fast growing, one Californian railroad using oil on 180 of its locomotives.

The author recognises that the only satisfactory method of burning oil is to atomise it into a refractory furnace with a sufficient air supply. In good practice the air supply need be but little in excess of the chemical minimum. The rate of combustion of oil is limited only by the rate at which the flame can be forced through the furnace. As regards the atomising agent, air appears to be the more economical if at a low pressure of 1 to 2, or even 5 to 10 lbs., but all burners or atomisers will not work at low-air pressures, and the cost in steam for compressing air to greater pressures, grows more rapidly than the efficiency of the compressed air, and when a high pressure is needed, steam is probably the more economical, but we may add it ought to be not merely dry, but superheated, and the oil ought to be preheated in order that it may lose its viscidity and atomise freely. Flat-mouthed atomisers seem to be much used in America. They get through more duty than circular atomisers.

M. Bertin, of the French Navy, who at one time was quite favourable to the use of air, has rather changed his opinion, and inclines to the use of steam. For marine work, however, the waste of fresh water must not be overlooked. Steam absorbs heat by its dissociation in the first part of a furnace, and gives it up again later. Its effect is, therefore, to prolong flame and reduce the intensity of local action. A usual form of preheater for oil is a piece of 6 in. or 8 in. pipe, capped at both ends, and serving as a passage-way for the oil on its way to the furnace. Inside it is a coil of small steam pipe. A temperature of 180° to 240° F. is usual, the limit of temperature being that none of the oil should be vaporised before it reaches the burner, or the atomising process will be interfered with.

Perfect furnace conditions are, as the author says, easier to secure with liquid than with solid fuel, but it may be also stated that, with imperfect conditions, liquid fuel will smoke so horribly that it has compelled good conditions to be observed, whereas with coal the smoke is not so offensive, and ignorance is still allowed to rule the combustion of coal, though it is well known that coal can be burned smokelessly in proper furnaces.

As some 15 lbs. of air must be applied to each pound of oil, it is clearly not practicable to put all the air through the atomiser. Hence the need for other openings to supply air, usually below the flames or at such points as are found necessary, as at the bridge, peep-holes being provided when possible, through which all parts of the furnace can be inspected. Air should be heated by passing it through channels which are laid in the flame bed and wherever air is admitted the temperature of the furnace must not have fallen below the temperature of ignition, or the fuel will remain unburned.

Until the world's production of liquid fuel has increased many times, the liquid fuel question must be treated in a conservative manner. Liquid fuel is so obviously suitable for special cases, such as the peaks of the load in a lighting station, and for various other uses, that it will always possess special value, but its universal application is as yet outside the region of commercial practicability.

ROYAL COMMISSION ON LONDON TRAFFIC.

A further sitting of the Royal Commission on London Locomotion was held on 15th inst., under the chairmanship of Sir D. Barbour, at the Westminster Palace Hotel

Evidence was given by Sir Richard Nicholson, the Clerk to the Middlesex County Council, who, in reply to the Chairman, said he was not prepared to give any opinion as to the desirability of appointing a tribunal to deal with the traffic problem, but would put before the Commission the position of Middlesex with regard to light railways and tramways. The population of Middlesex was 792,314, and was increasing very rapidly. The county was served by 11 railways. The majority of these railways had been unable to cope with the enormous traffic in the morning and evening between Middlesex and London, and had expressed themselves incapable of running any more local trains. Since the Light Railway Act was passed in 1896, and the decision of the Board of Trade that what are virtually tramways could be promoted under the Light Railway Act, numerous orders had been introduced for promoting so-called light railways along the main roads of the county. Middlesex had consistently opposed these applications, which, for the most part, entirely ran along the main roads of the county. The County Council took the view that the main roads belong to the inhabitants of the county at large, and that light railways traversing them ought to be under the control of the County Council as the authority under the Light Railways Act, and not under that of the various local authorities along the roads, as any arrangement of this sort might result in a deadlock in the working of the railway as a whole. Sir Richard went in great detail into the position of the County Councils, the schemes of the London United Tramways Co., the Metropolitan Electric Tramways Co., &c, and his conclusions might be thus summarised:—(1) As regards the west the difficulties were enormous owing to the foothold obtained by the London United Co. before 1896, or even 1889; (2) the action of the District Councils and the opposition of the London and South-Western Railway Co., together with the Parliamentary disabilities and the decisions of the Commissioners, made the position of the London United Co. well nigh impregnable; (3) the arrangement with them was an act of self-preservation; (4) the arrangement whereby, and whereby alone, the Council has acquired control of the North Metropolitan Co. has saved the raising of a large sum of money, is equally precedent.

Sir David Barbour (chairman) again took the chair at the sitting held on 22nd inst. at the Westminster Palace Hotel.

Mr. S. Morse, solicitor, was called, and stated that he had had large experience in the promotion of tramway schemes before Private Bill Committees and before the Light Railway Commissioners. He favoured the appointment of a tribunal to deal with the questions of London locomotion, and thought that after full inquiry their decision should be final. He took it that if such a tribunal were appointed and given powers to initiate schemes in the way of suggestion, it would be necessary to give them rather stringent powers, and if they followed the policy of the Boston Rapid Transit Commission, of course the authority would have power to raise money to carry out schemes. He considered that legislation by private Bill was not so satisfactory as the procedure before the Light Railway Commission. In the first place, the procedure before the Light Railway Commission was cheaper, and it was also more expeditious, inasmuch as the Commissioners went to the spot where the scheme was to be carried out, and all the parties devoted their whole attention to the matter. There were, on the other hand, certain difficulties in connection with the Light Railway Commissioners' procedure, and these, he took it, primarily arose from the fact that the Light Railways Act was passed as an experiment. It was a devolution of powers from a higher authority to a new body for a period of five years, and Parliament no doubt thought it better to give rather limited powers. Experience, he, thought, had shown that the powers of the Commission were more limited than it was advisable they should be. Owing to the operation of the Tramways Act the Light Railway Commissioners had always allowed the right of veto of local authority to tramways, although there was no provision for that in the Light Railways Act. He knew of cases where he represented the promoters, and the sole ground of objection by the local authority was that they objected to a company coming in, and although the Light Railway Commission considered the objection was unreasonable, still they refused to grant the order asked for. The Commissioners felt that so long as the Tramways Act was upon the statute book, they ought to consider the local authority. He admitted that the local authority should have a prominent voice in the matter, and should have the full opportunity to bring their views before the Commission, but he submitted that a scheme ought to be considered on its merits, and it should not lay in the power of a small unimportant local authority to defeat a scheme altogether. Then the Light Railway Commissioners with regard to tramways on roads had always followed the principle of the Tramways Act, and had given the local authorities a purchase clause, but his opinion was that the giving of a purchase clause to local authorities was not

the best way to serve the public interest. He thought instead of the purchase clause, there might be some authority given to the Commission or appointed tribunal to inquire if the company were working their undertaking to the public advantage, and that if they were charging too high fares and making large profits thereby, there should be power to amend the order so as to cause a revision of fares. Of course he took it that the tribunal would take all the facts into consideration, such as the capital expenditure and circumstances of that kind. From the public interest point of view, he did not think the objection to a purchase clause would be removed if it was laid down that the tramway or light railway should be purchased at its value as a going concern. It would meet the shareholders' point of view, but his opinion was that it was far better to have tramway undertakings managed by men of commercial experience under some control, as he had suggested rather than to have it worked simply as a speculation. He did not think that would prevent the capital being raised, and did not think many tramways or light railways had fallen through from want of capital. Under the Electric Lighting Acts they found that without any tribunal, companies reduced their charges greatly. If tramways were to be purchased as a going concern, the result might be the same as was now the case in Marylebone. There it was said the ratepayers were to be overburdened by the extortionate price which the Council said the public were to be called upon to pay. He was, of course, looking at it from the public point of view. It was no doubt the universal opinion that the Tramways Act had not facilitated the construction of tramways, for the veto of local authorities had discouraged promoters. He could tell them endless instances of that in his own experience. They not only had to get the consent of the local authorities for construction, but also for conversion of a tramway from horse traction to electric traction, because the earlier powers only gave horse traction. He knew a case of a group of tramways on which a company was prepared to spend £1,000,000 to electrify. They got the consent of all the authorities but one, who vetoed it. The reason they vetoed it was because they had an electrical tramway themselves, and could not make it pay, and in order to make it pay they wished to supply the company with electric current, and they wanted to charge an extortionate price. In London no company was able to get tramways, because the London County Council exercised their veto. He had not personally been concerned in the promotion of tramways in London, but in a speech made in the House of Commons by Mr. J. Burns on May 15th of last year, he stated that the local authorities had vetoed 38 proposals of the L.C.C. In Croydon the British Electric Traction Co. leased the tramways from the Corporation, and they had extended them. By making an agreement with the Beckenham local authority they were enabled to get to Beckenham, but they could not come to terms with Bromley, with the result that the extension to Bromley and beyond was stopped. Another difficulty which promoters had was the veto of frontagers, but this veto only applied in regard to tramways promoted by a Board of Trade order. If it was the case of a promoted Bill then Standing Orders only allowed a *locus*, and that he considered was sufficient. As compared with the Light Railway Commission the procedure under the Tramways Act was very expensive. It was twice as expensive, but the Tramways Act was still greatly used, because the Light Railway Commission had no power to alter a Tramway Act, and when existing tramway undertakers wanted to extend their tramways or to electrify them, procedure under the Tramways Act could not be avoided. He held that the Light Railway Commission had attached too much weight to the question of competition with existing railways. There was an application for a light railway or tramway between Egham and Staines, and it was opposed by the South-Western Railway, who alleged that they earned a revenue of £300 between those places, and that was sufficient to throw out the order. It would obviously be difficult to find places where such a revenue could not be earned. He did not say that the steam railway should not be considered, but it should be on the merits of the case. Under the Light Railway Act, again, the Commission had no power to direct that any other body should bear a portion of the expense of street widening which would form a public improvement. He considered that the tribunal for London should consist of four members, who should devote their whole time to the work, and that they should have wider powers than the Light Railway Commission in the direction he had indicated.

The Commission adjourned.

THE BETTER WAY.

After all reason generally triumphs sooner or later over unreason, the only trouble being that there is still such a large standing army enrolled under the cloudy banner of the latter force that the battle between the two is often prolonged and is always expensive. Perhaps, as education spreads, the enlightened will so out-number the dull that reason will be assured of a majority at the debates of every Council in England.

Although a perusal of the speeches made by members of the Wolverhampton Council during the late lengthy debate on the fate of the Lorain system leaves an unpleasant impression that many members of that Council have yet to be brought under the influence of reason evidently by the aid of education, it gives us much pleasure to record that these members are not in the majority.

For the reasons set forth in previous numbers of the Review, it must have been perfectly plain to the bystander, unaffected by the heat of the fight, that the only sane course open to the unfortunate experimenters was that leading to abandonment of the Lorain system. That course has been taken, and, as chronicled already, by the respectable majority of 11 (28 to 17).

In order to bear out our statement that better education is needed by some of the Councillors, we extract a few of the more remarkable arguments used to prove the case for the Lorain Co. :—"Mr. Shawfield had worked out that the total additional cost of the working of the Lorain system as compared with the overhead was equivalent to ·813d. per car-mile. He (Alderman Mander) had brought it down to ·613d. . . . Time would prove whether Mr. Shawfield's figures were more correct than his. . . . He would back his figures."

So we have the astounding picture of a paint, colour and varnish manufacturer setting his opinion, and asking a responsible body of men to set his opinion, against that of the specialist to whom the town pays a salary for the express purpose of advising them in these matters. However, judging from the second speech made by this worthy alderman, when he must have seen that the tide was running against his side, and thought it time to throw up his last sand wall, he is not obsessed so much by the Lorain system as by hatred—blind, sputtering hatred—of that veritable King Charles' head the B.E.T. Co.

The B.E.T. have long expressed a most laudable desire to give Wolverhampton the benefit, which only they can confer, of inter-communication with all the neighbouring towns, but, so long as the Lorain system exists inside the town, and the trolley system outside, so long is it impossible for such inter-communication to be effected—impossible, that is to say, within the region of practical politics.

This is how Mr. Mander feels towards any proposition of that sort :—"Those who are still against it (the Lorain system) are practically playing into the hands of the B.E.T. Co. I say you are playing into the hands of the B.E.T. Co. . . . . That company are working tooth and nail to get Wolverhampton by hook or by crook, and anything you do against the Lorain is practically in favour of the B.E.T. Co."

We no more hold a brief for the B.E.T. than does any member of the Wolverhampton Council, but we fail to see the logic of paying very much through the nose for a novel system of traction in order that an impassible stop-block may be maintained at every entrance to the town. In previous articles, we have been occupied so fully with other aspects of the case that we have omitted to enlarge on the matter of isolation, although this is one which directly affects a large and stable portion of the community, while undoubtedly indirectly touching the pockets of every inhabitant.

It is very evident from Mr. Mander's injudicious speeches, that he is possessed by a virulent antipathy to the B.E.T., and he has much to answer for to the tradesmen, and ratepayers generally, of Wolverhampton, if, simply to vent his spleen, he has introduced deliberately a system of traction which he must have foreseen would have the same effect as the re-erection of toll-bars at the approaches to the town, at which a prohibitive toll was authorised. Here we have well-illustrated the ill effects which too often arise from one man holding a majority of a Council in leading strings. If the man is of the type of, say, Mr. Joseph Chamberlain, it may be that all will be well, but men of that type are hard to find, and it sometimes happens that a man possessing wealth and a certain blunt obstinacy of character, which passes for a time as strength, and even as breadth of character, attracts and subordinates to himself, some as sycophants and some as believers, a sufficient number of adherents to carry through anything on which his mind is set. Sooner or later, depending on the average intelligence of the Council, the autocracy of this kind of man is broken, chiefly because he lacks the grand requirements of a true leader, namely, perfect mental balance, and an instinctively correct perception of perspective.

Alderman Mander seems to be a case in point, and his own exposure of his exploitation of his town for the purpose

of thwarting the perfectly legitimate aims of an outside, but British, company, should be sufficient to sap his misused power.

Whether the proposals of that company were acceptable or not was a question entirely for Wolverhampton to decide, and we have no criticism to offer now as to the wisdom of their decision; but we believe that, if the majority had not been swayed by one man, not only the Lorain system, but any surface-contact system, would have been scouted, and no system but that by means of which communication with the outside world could be maintained freely would have been considered. Thus no vexed question of comparative costs would have arisen; no loss, the actual extent of which has not yet been divulged, would have been sustained; and no arbitration with its dread possibilities would be now hanging over the town.

The dictum of a Councillor with respect to depreciation is generally worth reading, and the following was effused by one of the most powerful upholders of the experiment:—"A good many took up the position that if they borrowed money for any specific object, and for the life of that object (*sic*), and were compelled to pay back the money during that life, then it was a bit rough, after having to keep it in proper repair, as they as a municipality would have to do, to make out a reserve fund to give to posterity. A municipality had to keep a thing in repair; *it was not like a company, which let it get rotten.* The Corporation would keep up the plant in an efficient state, so that, at the end of the borrowing period, the plant would be practically the same as when they started with it. There was a great difference of opinion as to the question of reserve funds. No one would dream of asking them to put more than £4,000 or £5,000 aside for a reserve fund."

In that short paragraph is contained practically every fallacy which we have endeavoured to strangle since the day of its birth. Charmingly expressed, too. After all, perhaps Wolverhampton is lucky to have escaped with the Lorain system only.

Another Councillor included the following amusing medley in his speech:—"What does it matter what rates you pay? He would rather be in an up-to-date town and pay 10s. in the £, than be in a third-rate town badly managed. . . . The rates would go down. . . . We shall have to practise economy."

We understand a man with a brain clear enough to comprehend his own meaning deciding to vote for the system which will economise by raising the rates.

The debate was ended most appropriately by Mr. Mander, to whom the ensuing remarks are attributed: ". . . . if the Corporation went to arbitration, and if the Lorain Co. beat them in the Arbitration Court, they would have to pay something like £24,000 or £25,000 for the boxes in the ground. It would cost them at least £2,000 more to take up the boxes and put the road in order. . . . They would also have to spend £8,500 to put up the poles and wires for the overhead, which totalled to £35,000."

That is no more than the Corporation can expect under the circumstances mentioned by the speaker, but, we would ask, did he show the tact of a leader by smacking his lips over the recital of the possible pains and penalties, for the infliction of which he, as the hottest advocate of the rejected system, should be held primarily responsible?

As a final word, we congratulate Wolverhampton on its decision, and suggest that it will be far cheaper for the inhabitants in the long run to grin and bear the risk of an unfavourable arbitration (we hope sincerely that it will be favourable) rather than keep down the boxes and keep out the trade.

SOUTH AFRICAN NOTES.

(From our Special Correspondent at Johannesburg.)

May 4th, 1903.

Cape Electric Tramways, Ltd.—For the third time this Bill has been presented to Parliament, the object being to convert the Cape Suburban Railway system for electrical working. It has previously been thrown out, or, in face of strong opposition, been withdrawn, the objection being not to the electrification of the system, but to certain clauses in the Bill itself, which has not been materially altered since being first presented. It is not to be passed this time without a struggle; at the last City Council meeting it was unanimously agreed to oppose it.

Lourenco Marques.—Mr. R. M. Flatow, the managing director of Arthur Koppel & Co., Ltd., and Mr. Wheaton, of New York, of the same firm, have paid a visit to the Bay in connection with the 36 cranes (electrical) ordered from Arthur Koppel & Co. by the Portuguese Railway for installation at the sheds of the Custom House of Lourenco Marques. The cranes ordered are particularly adapted to the discharge of vessels on account of the length of beam, which extends over the width of three steamers; when once steamers can get alongside it will be possible to land goods in this way from three ships.

Johannesburg.—Mr. R. H. Covernton has been appointed the manager, *pro tem*, of the Johannesburg light and power department, and his salary raised to £1,000 with £80 horse allowance. Mr. Covernton has been acting manager since Mr. Cowell resigned in January, 1902. Under the new system four chiefs will be appointed, a chief manager and three subordinates, of whom Mr. Covernton will be one.

Johannesburg's supply of electric light is exhausted, and no application for lights can be entertained, though the winter is just coming on. That is the pith of a recent report prepared by the Tramway Committee, which runs as follows:—

"As the Council is aware, every effort has been made recently to increase the available sources of power, and arrangements have been made to obtain a supply from the Robinson Deep Gold Mining Co., and also for an additional supply from Brakpan. The present sources of supply are as follows:—(*a*) Town supply.—Total plant capacity is 755 KW.; (*b*) Brakpan supply.—Total capacity 700 KW.; (*c*) Robinson Deep Supply.—Total capacity 250 KW.

"The attention of the Committee, has, however, been drawn to the fact that since the beginning of the year 17,467 C.P. lamps have been applied for, and that the point has now been reached when no applications can be received, this being the maximum number of lamps that can be supplied from the available plant.

"We must also point out that the demand from the old consumers during the coming winter is likely to considerably exceed that of last year, when the town was, to a great extent, still under war conditions, but exactly to what extent cannot as yet be estimated."

The Committee propose to notify the public that no further applications for electric light supply can be accepted. The total number of applications received now is 394, of which some 150 have already been dealt with. Hence if all additional applications cease from now, there will be still some 240 new connections to clear off, *i.e.*, a sufficient number to occupy the present staff of this department for approximately three months, working at as high a pressure as can be obtained. In order to facilitate the carrying out of the work, the Committee recommend the employment of additional linesmen.

Transvaal Telegraphs.—The Transvaal post and telegraph services will import 1,000 tons of material during the coming year, and from 400 to 500 tons per year for the next five years.

DOUBLE COMBUSTION.

By W. H. Booth.

In a recently issued report by the Manchester Steam Users' Association, it is stated that the heat passing through the furnace plates is so excessive under the best conditions of firing that trouble may ensue. This danger may be obviated, we are then told, by either excessive or deficient air supply. The former is, of course, a very wasteful method of reducing furnace temperatures. By the latter method, however, good results may be secured if proper means are employed. Obviously the idea is to supply deficient air and make a gas producer of the furnace, burning the gas later. Incomplete combustion may give a temperature 2,350° F. above the atmosphere, whereas complete combustion gives a temperature of 4,130° F.

It is suggested that after the half-burned gas has been cooled to 731° by the boiler plates, it may again be ignited and raise itself again to 1,500° or 1,800°, so that the boiler would be exposed to a maximum temperature of 2,300° to 2,600° instead of to 4,130°, a matter of importance with greasy or scaling water. It is recognised that the second combustion must take place with brick surroundings, a very proper suggestion, but one which appears likely to involve a considerable extension of a boiler. To give the first imperfect combustion, thick fires and no above-fire air are necessary to make a gas producer of the furnace. Gas being thus formed, at proper air supply is to be given later. The questio n is, Wha amount of soot is going to be produced in the first half of the double process? Dry-back boilers are credited with having white-hot combustion chambers, and if these were made larger, it is suggested that a double combustion might be secured. It seems to us likely that much more than this is necessary, but if the Association can show a reasonable method of doing it, there would be effected a great economy in the firebricks of the perfect single combustion furnace, which, so far, has been often advocated. Without considerable boiler length, it does not seem to the writer that bituminous fuel can be perfectly burned except from the start.

The Association think that if the double system can be carried out with less excess of air than is common in ordinary practice, it would be possible to reduce the heating surface of the boiler, or with the same surface to get an 8 per cent. improved efficiency. There is some doubt, however, in respect of the efficiency of the first

stage heating surface. It would probably be thickly coated with soot and tar. Huge volumes of smoke would pass to the second combustion chamber, and it would probably be found that this was of excessive dimensions, and until it once became hot, there would be difficulty in burning the gases from the first stage. The idea is certainly worth trying, but it should only be attempted where there is ample room to construct the necessary brick chamber behind the boiler.

NEW PATENTS APPLIED FOR, 1903.

Compiled expressly for this Journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

10,609. "Electric illuminated blowing machine." A. Lamb. May 9th.

10,630. "An improved microphonic transmitter." A. Eckstein and A. Brooker. May 11th.

10,646. "Improvements in electric switches." G. W. Somerville and Howard and Bullough, Ltd. May 11th.

10,649. "Improvements in telephonic apparatus." A. R. Bennett. May 11th.

10,652. "Improvements in and relating to electric controllers or switches." G. W. Mascord. May 11th.

10,662. "Improvements in method of electric welding." C. A. Allison. (H. G. Underwood, United States.) May 11th.

10,665. "Improvements in arc lamps." J. E. Neale. May 11th.

10,667. "Improvements relating to submarine telegraphy." S. G. Brown. May 11th.

10,697. "A new or improved watt-hour meter." R. Ziegenberg. May 11th. (Complete.)

10,698. "Improvements relating to the phase synchronisation in electro-motors with alternating field." R. Ziegenberg. May 11th. (Complete.)

10,703. "Improvements in primary and secondary electric cells." G. Harrison. (M. Buffa, Italy.) May 11th. (Complete.)

10,728. "Improved secondary battery applicable for use as a pocket battery." W. Heym. May 11th.

10,742. "An improvement in and connected with the heating of ironing machines by electricity for use in laundries and the like." H. T. Pebworth. May 12th.

10,743. "An improved method of applying electrolytes to batteries." J. F. Wekelin and F. J. Turquand. May 12th.

10,748. "Improvements in couplings for electric conductor conduits, fittings, or other metallic pieces." R. Hodgkinson and C. Paynant. May 12th.

10,772. "Improvements in electric heaters and stoves." H. Binko. May 12th.

10,801. "A new or improved maximum demand indicator for alternating or direct electric currents." C. J. Evans. May 12th.

10,812. "Improved construction of trolley wire or line for electric traction." A. Latch and T. C. Batchelor. May 12th.

10,814. "Improvements in electric mining safety lamps with portable accumulators, and charging devices." E. Edwards. (O. Mallet and A. Parent, France.) May 12th. (Complete.)

10,858. "Improvements in electrical switches or circuit breakers." B. Thomas and E. Thomas. May 13th.

10,871. "An improved method of making electric switch covers." T. Bond, A. Deacon, and J. H. Leather. May 13th.

10,881. "Improvements in and relating to life guards for electric and similar cars." J. S. P. Rosling. May 13th.

10,927. "Improved protective and advertising device for telephones and the like." J. Effertz. May 13th.

10,950. "A radial car truck, for electric and other railways." R. L. Ellery and M. B. Ryan. May 14th.

10,997. "Improvements in insulator equipments for telegraph, telephone and like poles or posts." A. E. M. Rolland. (W. A. Manson, Natal.) May 14th.

11,000. "Improvements in electric crucible furnace." A. Reynolds. May 14th.

11,001. "An improved electric crucible furnace." A. Reynolds. May 14th.

11,002. "An improved method of melting steel and the like in electric resistance furnaces." A. Reynolds. May 14th.

11,033. "Improvements in controlling systems for electric motors." F. W. Le Tall. (G. Westinghouse and L. M. Aspinwall, United States.) May 14th.

11,049. "Improvements in electro-magnetic distance switches." H. J. Haddan. (M. Danziger, Germany.) May 14th.

11,069. "Improvements in electrically-driven organ blowing apparatus." A. Caldwell. May 15th.

11,088 "Improvements in electrical arc lamps." Guest, Keen & Nettlefold's, Ltd., and C. Wakeman, Jnr. May 15th.

11,108. "Improvements in and connected with steno-telegraph transmitting and stenographic recording systems and apparatus." A. C. Baronio. May 15th.

11,125. "Improvements in brush holders for dynamo-electric machines and electric motors." The Johnson-Lundell Electric Traction Co., Ltd. (R. Lundell, United States.) May 15th. (Complete.)

11,145. "Improvements in accumulator electrodes." R. Calandri. May 15th.

11,198. "Improvements in or relating to radiators for wireless telegraphy." A. Blondel. May 16th. (Complete.)

10,903. "Improvements in and relating to electric incandescent lamps." O. Könitzer. May 13th.

PUBLISHED SPECIFICATIONS, 1901.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

26,197. "Improvements in electric arc lamps." E. Batault. Dated December 23rd.

26,227. "Improvements relating to electro-magnetic switches and to methods of controlling or operating the same." H. H. Lake. (McElroy-Grunow Electric Railway System, Bridgeport, U.S.A.) Dated December 23rd.

26,229. "Improvements in or relating to secondary electric batteries." H. White. Dated December 23rd.

26,232. "Improvements in dynamo machines." C. K. Dumas. Dated December 23rd.

26,237. "Improvements in accumulators or secondary batteries." F. N. Blanc. Dated December 23rd.

26,251. "Improved means and appliance for starting electric lamps of the 'Nernst' kind." C. Cervenka. Dated December 23rd.

26,285. "Improvements in electric switches." H. Pieper. Dated December 24th.

26,367. "Improvements in connection with message counters for telephone exchanges." H. Oppenheimer. (Actiengesellschaft Mix & Genest, Berlin.) Dated December 24th.

26,340. "Improvements in controllers for electric motors." British Thomson-Houston Co. (O. Holz, Schenectady, U.S.A.) Dated December 24th.

26,341. "Improvements in multiple conductor systems of electrical distribution." British Thomson-Houston Co. (A. D. Lunt. Schenectady, U.S.A.) Dated December 24th.

26,342. "Improvements in electric arc lamps." British Thomson-Houston Co. (E. Thomson, Swampscott, U.S.A.) Dated December 24th.

26,343. "Improvements in electric arc lamps." British Thomson-Houston Co. (A. G. Davis, Schenectady, U.S.A.) Dated December 24th.

26,344. "Improvements in insulated electric conductors." British Thomson-Houston Co. (W. R. le Emmet and W. S. Clarke, both of Schenectady, U.S.A.) Dated December 24th.

26,345. "Improvements in means for transmitting electrical energy." British Thomson-Houston Co. (J. E. Woodbridge, Schenectady, U.S.A.) Dated December 24th.

26,346. "Improvements in and relating to the control of electric automobile vehicles" British Thomson-Houston Co. (H. Lemp, Lynn, U.S.A.) Dated December 24th.

26,347. "Improvements in systems of electric generation and distribution." British Thomson-Houston Co. (E. M. Hewlett, Schenectady, U.S.A.) Dated December 24th.

26,348. "Improvements in starting alternating electric current machines." British Thomson-Houston Co. (J. E. Woodbridge, Schenectady, U.S.A.) Dated December 24th.

26,349. "Improvements in electric transmission of power." British Thomson-Houston Co. (E. M. Hewlett, Schenectady, U.S.A.) Dated December 24th.

26,358. "Improvements in or relating to circuit breakers for electric current circuits." E. F. Moy, P. H. Bastie and E. F. Moy, Ltd. Dated December 24th

26,363. "An improved insulating material and process of manufacture of same." V. Karavodine. Dated December 24th.

26,369. "Method of and means for transmitting power from electro-magnetic devices to movable bodies." R. T. Glascondie and H. H. Kenshole. Dated December 24th.

26,377. "Improvements in induction electric meters." O. T. Blathy. Dated December 24th.

26,380. "Improvements in and relating to telegraph and like poles." W. B. Crossland. Dated December 24th.

26,420. "Improvements in the method of and means for ascertaining and recording the consumption of current in electrical traction." C. H. Berry and W. T. Hill. Dated December 27th.

26,472. "An improvement in single-phase alternating current motors." J. Burke. Dated December 27th.

26,476. "An improved electric switch." S. B. Marshall. Dated December 27th.

26,483. "Improvements in electric demand indicators." J. G. Lorrain. (H. A. Macdonald, Paris.) Dated December 27th.

26,484. "Improvements relating to third-rail conductors for electric railways." H. H. Lake. (Central Electric Construction Co., New York.) Dated December 27th.

26,485. "Improvements relating to third-rail conductors for electric railways." H. H. Lake. (Central Electric Construction Co., New York.) Dated December 27th.

26,487. "Carbide electrodes for arc lamps and process of manufacturing the same." R. Hopfelt. Dated December 27th.

26,510. "An improved insulator applicable to overhead tramway wires." J. A. Penny. Dated December 28th.

26,534. "Improvements relating to the laying of underground electric conductors for lighting and power." W. P. Thompson. (F. Davis.) Dated December 28th.

26,566. "Party line telephone system." F. E. Mayberry. Dated December 30th.

26,590. "Improvements in winding for electrical machines." B. G. Lamme. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, June 26th.) Dated December 30th.

26,600. "Improvements in and relating to telegraphic and telephonic systems." L. Maiche. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, July 19th.) Dated December 30th.

26,604. "Improvements in instruments for recording varying magnetic fields or the currents producing them." Siemens Bros. & Co. (Siemens & Halske, Aktiengesellschaft, Berlin.) Dated December 30th.

26,634. "Means for connecting an alarm bell on a local system to the telephone exchange." P. Rabbidge. Dated December 30th.

26,659. "Improvements in electric light brackets or pendants." R. Wallwork and C. H. Wallwork. Dated December 31st.

26,673. "Improvements in apparatus for the generation and electrolytic application of electric currents." F. E. Elmore. Dated December 31st.

26,690. "Improvements in electric arc lamps." British Thomson-Houston Co. (E. Thomson, Swampscott, U.S.A.) Dated December 31st.

26,691. "Improvements in electric circuit controllers." British Thomson-Houston Co. (E. M. Hewlett, Schenectady, U.S.A.) Dated December 31st.

26,692. "Improvements in electric current controlling devices." British Thomson-Houston Co. (S. L. Knox, Schenectady, U.S.A.) Dated December 31st.

26,693. "Improvements in electric circuit breakers." British Thomson Houston Co. (R. H. Read, Schenectady, U.S.A.) Dated December 31st.

26,694. "Improvements in electric circuit-breakers." British Thomson-Houston Co. (R. H. Read, Schenectady, U.S.A.) Dated December 31st.

26,695. "Improvements in dynamo-electric machines." British Thomson-Houston Co. (H. Geisenhoner, Schenectady, U.S.A.) Dated December 31st.

26,696. "Improvements in electric rheostats." British Thomson-Houston Co. (J. L. Hall, Schenectady, U.S.A.) Dated December 31st.

26,697. "Improvements in electric rheostats." British Thomson-Houston Co. (W. C. Yates, Schenectady, U.S.A.) Dated December 31st.

26,698. "Improvements in systems of electric distribution." British Thomson-Houston Co. (C. P. Steinmetz, Schenectady, U.S.A.) Dated December 31st.

26,700. "Improvements relating to the electric lighting of railway trains and to apparatus therefor." D. C. Henry. Dated December 31st.

26,702. "Improvements in controlling devices for connecting storage batteries with a charging circuit." J. W. Stover and N. H. Suren. Dated December 31st.

26,729. "Improvements in electric battery." J. T. Bain and J. O. Hunt. Dated December 31st.

26,742. "Improvements in electric motors for driving sewing machines or other similar apparatus." R. H. Wellman. Dated December 31st.

26,743. "Improvements in electric arc lamps." J. H. Hallberg. Dated December 31st.

26,744. "Improvements in and relating to signalling on electric traction systems." T. H. Jones. Dated December 31st.